



## INSTALLATION, SERVICE AND MAINTENANCE INSTRUCTIONS

# FMI VERTICAL AGITATOR



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Original Manual

20.007.30.00EN\_RevB

ED. 2012/02



## EC DECLARATION OF CONFORMITY

(according to Directive 2006/42/EC, annex II, part 1, section A)

Manufacturer: INOXPA, S.A.  
C/ Telers, 54  
17820 Banyoles (Girona) - SPAIN

Hereby declares, that the product:

**VERTICAL AGITATOR**

Name

**FMI**

Type

conforms to the specifications of the Council Directive:

**Machine Directive** 2006/42/EC, and complies with the essential requirements of the Directive and Harmonised Standards:

UNE-EN ISO 12100-1/2:2004  
UNE-EN ISO 13857:2008  
UNE-EN 953:1998  
UNE-EN ISO 13732-1:2007

**Low Voltage Directive** 2006/95/EC (what repeal 73/23/CEE Directive), and are conforms with UNE-EN 60204-1:2006 and UNE-EN 60034-1:2004

**EMC Directive** 2004/108/EC (what repeal 89/336/CEE Directive), and are conforms with UNE-EN 60034-1:2004

In compliance with the Regulations **(CE) n° 1935/2004**, relating to materials and articles intended to come into contact with foodstuff (repeal Directive 89/109/CEE), the materials in contact with the product do not transfer their components in quantities which may jeopardise consumer's health or safety

Banyoles, 2012

Josep Maria Benet Technical Manager

# 1. Safety instructions.

## **SAFETY INSTRUCTIONS.**

This instruction manual contains the basic indications that should be complied with during installation, start-up and maintenance. Consequently, it is essential that, before installation, both the installer and the plant technical manager read this instruction manual and that it be permanently available alongside the agitator or corresponding installation.

Not only must the detailed safety instructions in this chapter be complied with, but so also should the special measures and recommendations added in the other chapters of this manual.

## **SYMBOLS USED.**

The safety instructions included in this manual, whose non-compliance may cause risk to persons or to the machine and its correct operation, are expressed by means of the symbols indicated below:



**Danger to people in general.**



**Electrical hazard.**



**Danger of injury caused by the agitator.**



**Danger due to suspended loads.**



**Danger for the agitator and its correct operation.**



**General obligation.**

## GENERAL SAFETY INSTRUCTIONS.



- Read the instructions in this manual before installing the agitator and before starting it up.
- The installation and use of the agitator must always be in accordance with the rules applying to health and safety.
- Before starting up the agitator, check that it be correctly anchored and that the shaft be perfectly aligned. Poor alignment and/or excessive force in fitting, may cause serious mechanical problems for the agitator.



- Specialised personnel should carry out all electrical work.
- To control the engine characteristics and its control panel, especially in areas where there is a risk of fire or explosion, the user company's technical manager shall establish danger areas (area 1 – 2 – 3).
- Do not spray the motor directly during cleaning.
- Do not disassemble the agitator without previously disconnecting the power supply. Remove the fuses and disconnect the motor feed cable.



- Do not operate the agitator if turning components do not have the protection system or if they are badly fitted.
- The agitator has rotating parts. Do not put hands or fingers into an agitator whilst it is operating. This may cause serious injury.
- Do not touch any of the parts of the agitator that are in contact with liquid whilst in operation. If the agitator works with hot products at temperatures exceeding 50 °C, there is a risk of burns. In these cases, collective protective measures should be put in order of priority (distance, protective screen, heat resistance), or –failing this possibility- to provide individual protection (gloves).



- Take all possible precautions in lifting the agitator. Always ensure that it securely attached when being transported by crane or any other lifting mechanism.



- Withdraw all the tools used in mounting before starting up the agitator.
- The agitator is unable to work without liquid. Standard agitators are not designed to operate during the filling or emptying of tanks.



- Do not exceed the agitator's maximum operating conditions. Do not modify the operating parameters that were initially set for the agitator without the prior written consent of INOXPA.
- The agitators and their installation may cause noise levels that exceed 85 dB (A) in some unfavourable operating environments. In such cases, operators should wear hearing protection.

#### **WARRANTY.**

We wish to point out that any warranty issued will be null and void and that we are entitled to an indemnity for any civil liability claim for products which might be filed by third parties if:

- operation and maintenance work has not been done following the corresponding instructions; the repairs have not been made by our personnel or have been made without our written authorization;
- modifications are made to our material without prior written authorization;
- the parts or lubricants used are not original INOXPA parts/lubricants;
- the material has been improperly used due to error or negligence or have not been used according to the indications and the intended purpose.
- all components subject to wear are excluded from the guarantee.

The General Delivery Terms which you have already received are also applicable.

#### **INSTRUCTIONS MANUAL.**

The information provided in the instruction manual refers to updated data.

We reserve the right to modify the design and/or manufacturing specifications of our products as required, devoid of any obligation on our part to adapt any product supplied prior to such alteration.

The technical information made available in this instruction manual, together with the graphs and technical specifications provided, shall continue to belong to us and should not be used (except for starting up this installation), copied, photocopied, made available or otherwise given to third parties without our prior written consent.

INOXPA is reservation the right to modifying this instructions manual without previous notice.

#### **INOXPA SERVICE.**

In the event of doubt or should you require a fuller explanation on particular data (adjustment, assembly, disassembly...), please do not hesitate to contact us.

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## 2. Reception, storage and transport.

### RECEPTION.

On reception of the agitator, check the packing and its contents to ensure that it agrees with delivery note. **INOXPA** packs the agitators fully assembled or disassembled according to the case. Ensure that the agitator has not suffered any damage. In the case of it being found not to be in correct condition and/or some part(s) are missing, the transporter shall have to prepare a report as quickly as possible.

### STORAGE.

If the agitator is not immediately installed, it must be stored in an appropriate place. The shaft must be stored in a horizontal position and on some wooden or similar supports. The shaft in such a position will not become deformed and must not support loads of any description.

### TRANSPORT.

Take all possible precautions in lifting the agitator. Always use the sling hooks when moving the agitator with a crane or any other type of lifting equipment.



**Depending on the model, the agitators are too heavy to store or install manually. Use an adequate means of transport. Do not manipulate the agitator by the shaft because it can easily become deformed.**

Type	Wight [Kg] with IEC motor, IP-55	Wight [Kg] with IEC motor, flameproof
FMI-B-1.10-4022-200	65	87
FMI-B-1.10-4030-200	68	90
FMI-C-1.10-4040-225	86	119
FMI-C-1.10-4055-250	99	143
FMI-D-1.10-4075-250	151	197
FMI-D-1.10-4110-275	175	259
FMI-D-1.10-4150-300	190	274
FMI-D-1.10-4185-300	237	328
FMI-E-1.10-4220-325	347	442
FMI-B-1.4-4022-150	65	87
FMI-C-1.4-4040-200	85	118
FMI-C-1.4-4055-200	98	142
FMI-D-1.4-4075-255	151	197
FMI-D-1.4-4110-290	175	259
FMI-D-1.4-4150-330	191	275
FMI-D-1.4-4185-330	238	329
FMI-E-1.4-4220-330	348	443
FMI-E-1.4-4300-390	391	479
FMI-F-1.4-4300-390	495	583

## 3. Identification, description and use.

### IDENTIFICATION.

The agitator is identified by means of a plate stating its characteristics attached to the bearings support. The type of agitator and serial number are on the plate. See figure 3.1.

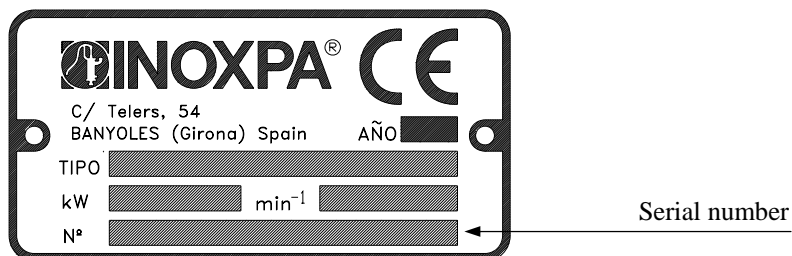


Figure 3.1: Characteristics plate.

### Example:

**FMI - B - 1. 10 - 4 022 - 200**

1      2      3    4      5      6      7

**1. Name of the agitator.**

FMI = vertical agitator with motor.

**2. Gear-box size.**

B, C, D, E, F.

**3. Number of agitation elements.**

1 = one agitation element.  
2 = two agitation elements.

**4. Type of agitation elements.**

10 = marine type.  
4 = sawtooth type

**5. Motor speed.**

4 poles = 1500 rpm.  
6 poles = 1000 rpm.

**6. Motor power.**

022 = 2.2 kW.  
040 = 4 kW.  
075 = 7.5 kW.

**7. Diameter of the agitation element.**

200 = 200 mm.  
250 = 250 mm.  
300 = 300 mm.



## **DESCRIPTION.**

The FMI series range is vertical agitators with motor, a stainless steel base and a V-ring as the sealing system. The agitator shaft is fixed onto the half shaft with a flange mount.

Although these agitators are very compact, they have a head that is totally independent of the motor. The half shaft is guided by two bearings that can withstand the thrust and radial load transmitted by the mixing element.

All the parts that come into contact with the product are made of stainless steel, AISI-316 (1.4401) for mixers with propeller and AISI-304 (1.4301) for those with sawtooth elements. It has a sand blasted surface finish.

The standard propellers from this agitators range are marine propeller (type 10) and sawtooth propeller (type 4).

## **USE OF THE AGITATOR.**

They are used for mixing and blending processes in open or closed tanks and with a variable viscosity between 1 to 2000 cPs (up to 6000 cPs. for the sawtooth propeller).

# 4. Installation and assembly.

## INSTALLATION AND ASSEMBLY.



**If the agitator is supplied without a drive or other element, the purchaser shall be responsible for its assembly, installation, start-up and operation.**

### SITE.

Place the agitator in such a way as to facilitate inspection and servicing. Leave sufficient room around the agitator for adequate servicing, separate, even when it is in operation. It is very important to be able to obtain access to the electrical connection mechanism of the agitator, even when it is in working mode.

To achieve an effective mixing process it may be necessary to fit baffles to the bottom of the tank. Consult our technical department for each particular application. If required, the approximate dimensions of the baffles in relation to the diameter of the tank are shown in figure 4.1 and table 4.1.

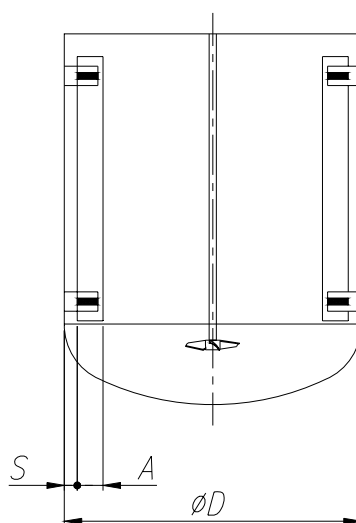


Figure 4.1

Ø D	300	400	500	600	800	1000	1200	1600	2000	2500	3000	3500	4000
A	20	30	35	40	50	70	80	115	130	180	200	240	280
S	5	5	10	10	10	15	20	20	30	30	50	50	50

Table 4.1

### ASSEMBLY.

To locate and fix the agitator in the support flange of the tank, the propeller must be removed from the shaft. Once the base of the agitator is placed on the supporting flange, the fixing nuts and screws will be assembled in their corresponding holes, without being tightened. When this operation has been carried out, the agitator must be levelled using the following method.

- Place a spirit level against the shaft.
- Check 4 points at 90° to each other around the circumference of the shaft and at the same height.

Once the shaft is level, firmly tighten the fixing nuts and screws. Finally the propeller is mounted on the end of the shaft. Be careful when assembling the shaft not to hit or strain it so as to avoid it being bent.



**Force should never be applied to the end of the agitator shaft, as it can easily suffer permanent damage.**

**Check the alignment of the agitator shaft with the half shaft once its assembly is completed.**

## **ELECTRICAL CONNECTION.**

Before connecting the electric motor to the mains, check the local regulations and the corresponding standards regarding electrical safety. Take special account of those parts referring to command and control of the agitator. Check the manufacturer's instruction manual of the motor for connecting it to the mains.

**Let the electrical connection of the motors to qualified personnel. Take the necessary measures in order to prevent any type of breakdown.**



**The motor should be protected with devices against overload and short-circuits.**

**It is not possible to use the agitator in areas of risk of fire or explosion if this has not been included in the order. Risk areas (zones 0 -1 - 2).**

## 5. Start-up, operation and shutdown.

Agitator start-up shall be able to be carried out if the detailed instructions in the section on installation and assembly have previously been realised.

### START-UP.

- Check that the electrical supply is appropriate for what is indicated on the motor plate.
- Check the alignment of the agitator shaft.
- Check the tank's liquid level. Unless specified in the order, the agitators cannot function during tank filling or emptying.



**The agitator can NEVER run without a product. The agitation element must be submerged at least to a height between 1 to 2 times its diameter.**

- All the protectors must be in place.
- Start up the agitator.
- Check that the rotation of the propeller is correct (clockwise when viewed from the side of the motor). See figure 5.1.



**Respect the direction of rotation of the agitation element as indicated by the arrow stuck on the motor. The wrong direction will cause a loss of agitation efficiency.**

- Check the motor's electrical consumption.

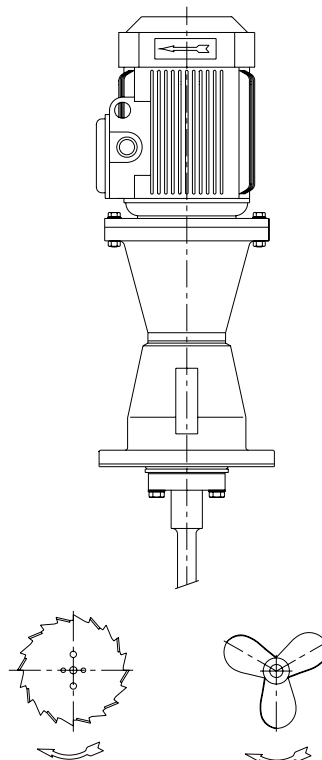


Figure 5.1

## OPERATION.



**Do not modify the operating parameters for which the agitator was initially selected without prior written consent of INOXPA. (Risk of deterioration and danger for the user).**

**Follow the operating instructions and safety indications described in the instructions manual of the tank on which the agitator is mounted.**



**Mechanical hazards (drag, shearing, cutting, strike, squashing, clipping. etc.). If the agitation element is accessible from above or at the man way of the tank then the user is exposed to the aforementioned hazards.**

The tank should be equipped with protection devices and safety equipment. Check the manufacturer's instructions manual.



**The introduction of a solid object or raw material may cause breakage of the agitation element or the breakage of other mechanical parts and endanger safety.**

## 6. Maintenance and conservation



Maintenance work can only be carried out by qualified personnel that are trained and equipped with the necessary resources to carrying out this work.

Before beginning maintenance work, ensure that the electric motor is disconnected and that the tank is empty.

### MAINTENANCE.

- Inspect the agitator regularly.
- Do not fail to keep the agitator clean.
- Check the state of the motor.
- Check the state of the bearings.
- Check the sealing: V-ring.

Motor maintenance shall be carried out in accordance with the manufacturer's instructions. See the instructions manual.

### LUBRICATION.

The vertical agitators of the FMI models are supported on permanently lubricated bearings, which means maintenance is not required. The bearings can be re-greased disassembling the support, cleaning thoroughly to remove the old grease or changing them as well as the bearing housings and, finally, applying new grease at 50-70%.

When re-greasing, use only special grease for ball bearings with the following properties:

- Lithium-based or made up of high quality lithium.
- Viscosity 100 - 140 cSt at 40 °C.
- Consistency NLGI grade 2 or 3.
- Continuous work temperature - 30 °C to + 120 °C.

The greasing of the motor bearings shall be carried out in accordance with the manufacturer's instructions.

### SPARE PARTS.

To order spare parts it is necessary to indicate the type and serial number included on the agitator's characteristics plate, as well as the position and description of the part as found in chapter 9, of technical specifications.

### CONSERVATION.

If the agitator is out of service for a considerable period of time, clean and treat the parts with VG 46 mineral oil. The shaft must be stored in the horizontal position and on wooden supports or on supports of a similar material.

## 7. Operating problems: causes and solutions.

Operating problems	Probable causes
Motor overload.	1, 2.
Insufficient agitation.	1, 3, 4, 5.
Vibrations and noise.	6, 7, 8, 9.
leakage.	10.

Probable causes		Solutions
1	Viscosity of the liquid too high.	Reduce the viscosity, e.g. by heating the liquid.
2	High density.	Increase motor power.
3	Tank too big for the chosen agitator.	Check with the technical department.
4	Wrong direction of rotation.	Change direction of rotation.
5	Agitator speed too low.	Increase the speed.
6	Liquid level insufficient or none.	Check liquid level in the tank.
7	Shaft bended.	Replace the shaft.
8	Critical speed.	Check with the technical department.
9	Worn bearings.	Replace the actuating bearings.
10	V-ring worn or damaged.	Replace the V-ring.



**If the problems persist stop using the agitator immediately. Contact the agitator manufacturer or the representative.**

## 8. Disassembly and assembly.

The assembly and disassembly of the agitators should only be carried out by qualified personnel. Ensure that staff read this instruction manual carefully, especially those parts that make direct reference to their work.

### ELECTRICAL SAFETY.

Ensure that the motor starter is turned off when carrying out disassembly or assembly work on the agitator.



- Place the agitator switch in the “off” position.
- Block the electrical panel and put a warning notice on it.
- Take out the fuses and take them with you to the work area.

### DISASSEMBLY.

Once the motor is disconnected, disassembly work may begin:

- Remove the screws which fix the agitator to the tank, and lift it a little to disassemble the agitator shaft (05) from the half-shaft (26). Remove the screws (52A) and washers (53A). Hold the agitator shaft (05) during this process.
- Proceed with disassembling the whole head assembly in a suitable place.
- Remove the V-ring (81).
- Remove the countersunk screws (50) and the base plate (42).
- Disassemble the motor (93) removing the screws (52), washers (53) and nuts (54).
- Remove half coupling flange (90) of the motor by means of a suitable tool, firstly loosen the stud (55A).
- After release the elastic ring (66B), remove the other half coupling flange from the half shaft (26) in the B, D, (T.160-180), E and F gearbox sizes. Then remove the key (61).
- Remove the elastic ring (66) with suitable pliers. The bearing cover (12) will be free from the half-shaft.
- Remove the half-shaft (26) with the bearing (70) assembled, with gentle taps with a plastic hammer, from the upper part of the half-shaft (motor side). The other bearing (70A) will be location in the lantern (04). For D gear-box size both bearings will be location in the half-shaft.
- Disassemble the bearing support (06) of the lantern (04) removing the allen screws (51) through the lower side of the support.
- Remove the bearing (70A) location in the lantern (04) in the B, C, E and F gearbox sizes. Take off the elastic ring (66A) with suitable pliers. The separator (64) will come off. Remove the bearing (70) with a press, as shown in figure 8.1.

### ASSEMBLY.

- Position the bearing cover (12) in the half-shaft (26), leaving it loose underneath.
- Assemble the bearing (70) to the half-shaft (26) and fix it with the separator (64) and the elastic ring (66).
- Put the lantern (04) in the bearing support (06) fitting the allen screws (51) from the interior of the support.
- For the D gearbox size, put the bearing (70A) in the half-shaft (26), and then fit the half-shaft (26) with the pieces already in place, until the bearing (70) is positioned. Fix the whole assembly with the elastic ring (66).
- In the other gearboxes B, C and E put the separator (64A) in the half-shaft (26) (F size does not take separator). Then, fit the half-shaft (26) with the pieces already in place, until the bearing is positioned. Fix the whole assembly with the elastic ring (66).
- Fit the other bearing (70A) until it touches to the half shaft (26) or separator (64A), according the size. In B size after bearing (70A) add another separator (64B).
- Position the key (61) and enter the half coupling flange with the aid of plastic hammer. Fix all with the elastic ring (66B).
- Put the other half coupling flange (90) in the shaft motor (93) and fix with the stud (55A).
- Fit the motor on the lantern (04) facing the holes of the half coupling flange with the bolts of the other half coupling flange. For this operation, turn with the hand the half shaft. Finally, fit the screws (52), washers (53) and nut (54).

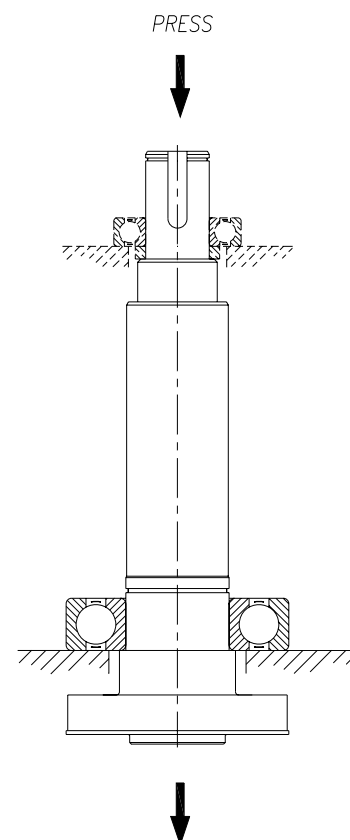


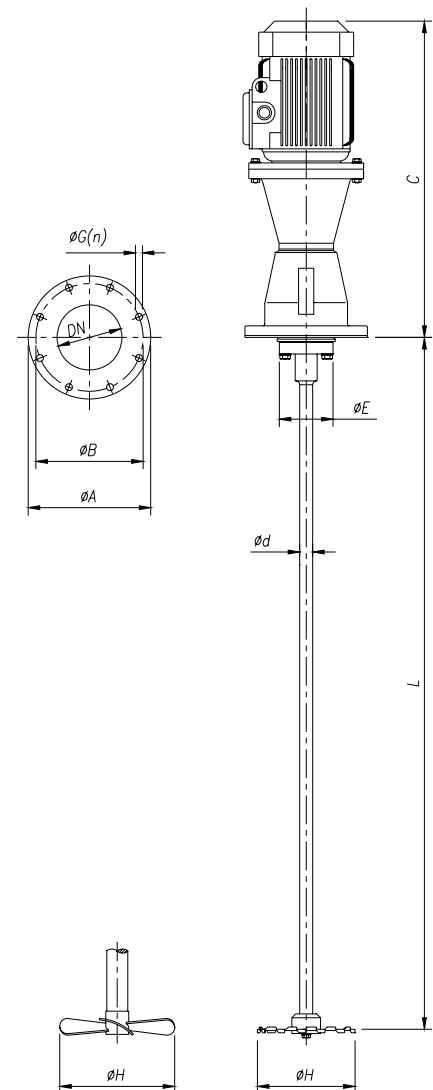
Figure 8.1



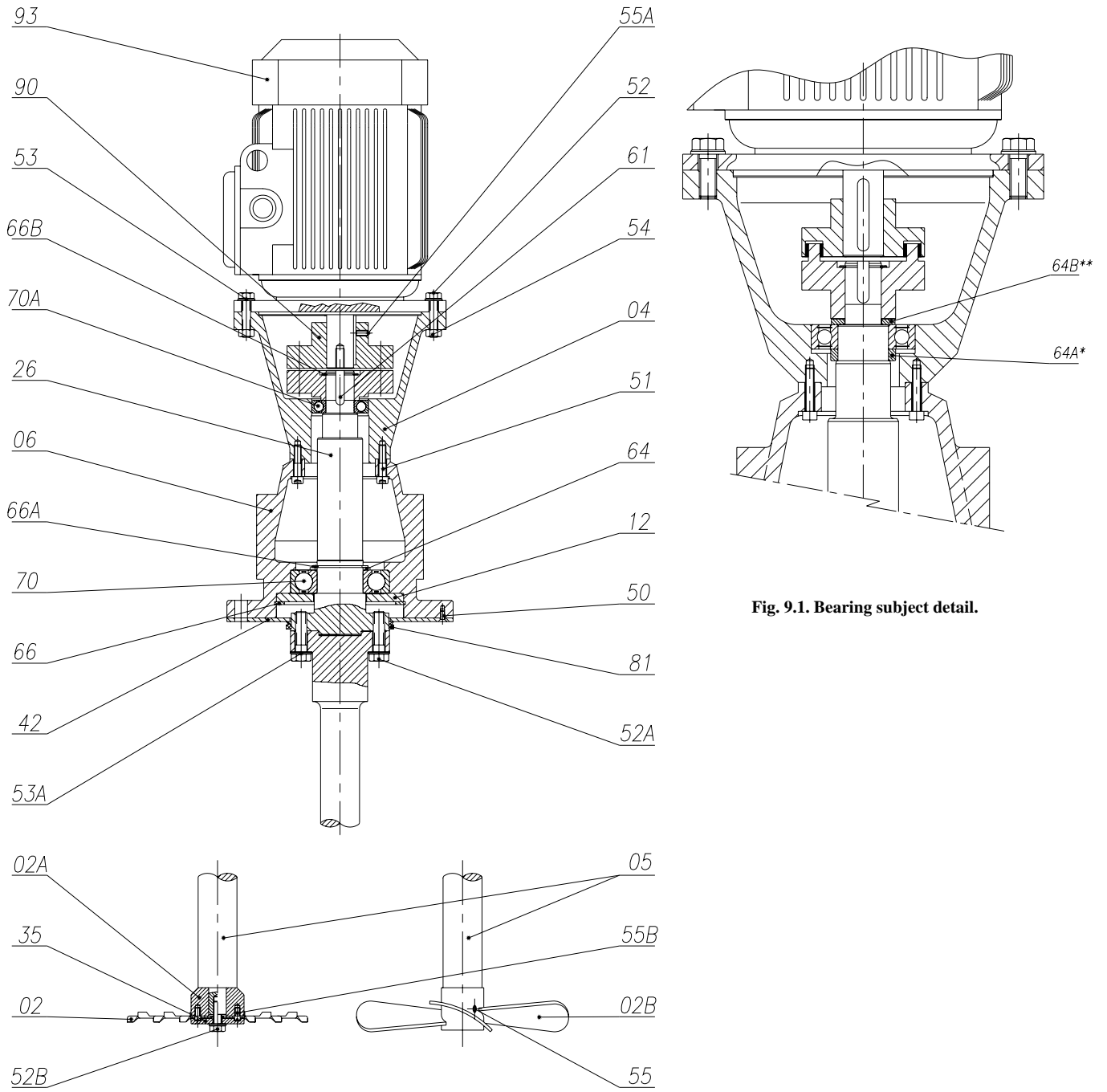
# 9. Technical specifications.

## TECHNICAL SPECIFICATIONS AND DIMENSIONS.

Agitator type	Motor power [Kw]	Speed [r/min]	Gear-box size	Dimensions						Agitator shaft		Type		
				C	$\phi E$	Flange				$\phi d$	$L_{max}$	$\phi H$	$\phi H$	
						$\phi A$	$\phi B$	$\phi DN$	$\phi G(n)$					
<i>FMI-B-1.10-4022-200</i>	2,2	1450	B	625	105	240	200	125	18 (8)	40	1800	200		
<i>FMI-B-1.10-4030-200</i>	3			685	125	265	225	150		45	2000	225		
<i>FMI-C-1.10-4040-225</i>	4		750	C					835	140	320	280		200
<i>FMI-C-1.10-4055-250</i>	5,5		1005		D	1060	1060	200						
<i>FMI-D-1.10-4075-250</i>	7,5		1060	E					1165	160	375	335		250
<i>FMI-D-1.10-4110-275</i>	11		1060		D	1005	140	320						
<i>FMI-D-1.10-4150-300</i>	15		1060	E					1165	160	375	335		250
<i>FMI-D-1.10-4185-300</i>	18,5		1060		F	1285	220	490						
<i>FMI-E-1.10-4220-325</i>	22		1060	B					625	105	240	200		125
<i>FMI-B-1.4-4022-150</i>	2,2		1450		C	685	125	265						
<i>FMI-C-1.4-4040-200</i>	4	750		D					835	140	320	280	200	55
<i>FMI-C-1.4-4055-200</i>	5,5	1005			E	1060	1060	200						
<i>FMI-D-1.4-4075-255</i>	7,5	1060		F					1285	220	490	445	350	23(12)
<i>FMI-D-1.4-4110-290</i>	11	1060			E	1165	160	375						
<i>FMI-D-1.4-4150-330</i>	15	1060		F					1285	220	490	445	350	23(12)
<i>FMI-D-1.4-4185-330</i>	18,5	1060			B	625	105	240						
<i>FMI-E-1.4-4220-330</i>	22	1060		C					685	125	265	225	150	55
<i>FMI-F-1.4-4300-190</i>	30	1060			D	835	140	320						



**FMI AGITATOR.**



**Fig. 9.1. Bearing subject detail.**

## FMI PARTS LIST.

Position	Quantity	Description	Material
02	1	Sawtooth turbine	AISI-304
02A	1	Turbine bucket	AISI-304
02B	1	Marine propeller	AISI-316
04	1	Lantern	Aluminium
05	1	Agitator shaft	AISI-316
06	1	Bearings support	GG-15
12	1	Bearings cover	F-1140
26	1	Half shaft	AISI-316
35	1	Turbine washer	AISI-316
42	1	Base plate	AISI-316
50	4	Countersunk screw	A2
51	6	Allen screw	8.8
52	4	Hexagonal screw	8.8
52A	6	Hexagonal screw	A2
52B	1	Hexagonal screw	A2
53	4	Flat washer	8.8
53A	6	Flat washer	A2
54	4	Hexagonal nut	8.8
55	2	Stud	A2
55A	1	Stud	8.8
55B	2	Dragging pivot	A2
61	1	Key	Steel
64	1	Separator	8.8
64A*	1	Separator	F-1140
64B**	1	Separator	F-1140
66	1	Elastic ring	Steel
66A	1	Elastic ring	Steel
66B	1	Elastic ring	Steel
70	1	Ball bearing	Steel
70A	1	Ball bearing	Steel
81	1	V-ring	NBR
90	1	Coupling flange	F-1140
93	1	Motor	-

\* B, C y E bearings support.

\*\* B bearings support. (see fig. 9.1)

**SEALING: V-RING.**

