



POSITIVE DISPLACEMENT FLOWMETERS

MOD. 212 - 612 - 114

INSTALLATION OPERATION AND MAINTENANCE

PETROL INSTRUMENTS S.r.l. - 04011 APRILIA (LT) - ITALY



INSTALLATION OPERATION AND MAINTENANCE MANUAL

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General

"PETROL" PD flowmeters are instruments capable of measuring the volume of flowing liquids with a standard accuracy of $\pm 0,5\%$ for general purposes and $\pm 0,2\%$ for fiscal transactions.

The PD flowmeters of our construction have been employed since many years by different industries (such as ship-building, steel making, power generation plants, refineries and depots, chemical, pharmaceutical and textile industries) of many Countries and have always satisfied the users for their good performances and dependable service during the years.

This manual has been prepared for people responsible of instruments actual installation and, at same time, for people responsible of instruments maintenance and service control.

INVOLVED PERSONNEL ARE KINDLY REQUESTED TO READ THOROUGHLY THE PRESCRIPTIONS CONTAINED IN THIS MANUAL, ESPECIALLY THOSE RELEVANT TO PD FLOWMETERS INSTALLATION BEFORE THEIR START-UP.



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Construction

- 2.1. PD flowmeter is mainly composed of the measuring unit ass'y and the indicator unit (see drawing 1).
- 2.2. The indicator unit, available in various types and models, is that required for the specific application.
- 2.3. The measuring unit ass'y is composed of three (3) main sub-ass'y, namely:
 - the outer housing;
 - the inner housing ass'y;
 - the coupling ass'y.

The outer housing is the part that withstands the liquid pressure and its construction is in accordance to max. expected pressure of flowing liquid.

The inner housing ass'y is the part through which the flowing liquid volume is accurately metered through the revolutions of rotors.

The coupling ass'y is the part through which the number of rotors revolutions is transmitted to indicator unit for integration and display of volumes metered.



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Application Limits

PD flowmeters must only be used within the limits specified in the name-plate, i.e. only for liquids, flow rates, temperature, max pressure and viscosity as specified in the name-plate (see drawing 1).

IT IS THEREFORE IMPERATIVE TO POSITIVELY CHECK THE NAME-PLATE BEFORE FLOWMETER START-UP.



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Installation Instruction

PRECAUTIONS

The majority of flowmeter failures are caused by infiltration of solid particles from outer housing flanges during "inoperative conditions". It is therefore very important:

- to remove the flanges protections only immediately before the instrument installation;
- to absolutely prevent the entering of solid particles into measuring unit ass'y during installation.

INSTRUCTIONS

1. During flowmeter installation avoid that deformation and/or stresses are induced into outer housing from the connecting pipes. IF THE PD FLOWMETER IS EQUIPPED WITH ANCHORING PLATES, BOLT THEM STRONGLY TO AVOID VIBRATIONS.
2. Check that actual flow direction is the same indicated by the arrow on the flowmeter outer housing and/or in accordance to the "in" and "out" name-plates attached to inlet and outlet flanges of the flowmeter.
3. For the measure of very viscous liquid at ambient temperature it is recommended to provide heating for both line and flowmeter (if necessary jacketed type PD flowmeters are available).



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Installation Instruction

4. It is recommended to provide enough space over the flowmeter for top-cover removal as well as for inner housing ass'y removal.
5. It is good practice to install a strainer directly before the flowmeter. However if plant configuration does not permit the direct coupling of flowmeter and strainer it is imperative to clean thoroughly, before flowmeter installation, the spool pipe used for strainer and flowmeter connection.
6. In case of new lines and especially in case of new and long lines flush completely the lines themselves, by pumping liquid in the piping, before flowmeter installation or, should such operation be impractical, remove the inner housing ass'y from outer housing when flushing the lines.

INSTALLATION EXAMPLES

1. Wherever possible install the flowmeter on a by-pass as shown in drawing 2 for its easier disassembly and inspection.
2. When an appreciable quantity of solid particles is expected to be present in the flowing liquid, install strainers in parallel for alternate use or install two strainers as shown in drawing 3.
3. In case gas bubbles are expected in flowing liquid, install a suitable deaerator as shown in drawing 4.



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Start-up and Operating Instruction

1. For new lines let liquid flow through the by-pass in order to completely wash away any scale traces (scale remaining in the lines might cause unusual wear of bearings and of timing gears).
2. In the case that PD flowmeter is not installed on a by-pass or in the case that the line has not a by-pass, remove the inner housing ass'y from the PD flowmeter outer housing flanged to the piping and let liquid flow through the line until the line itself is completely clean and any trace of scale has been washed away. After such kind of line flushing has been completed, install the inner housing ass'y into the outer housing and proceed with the PD flowmeter start-up.
3. To start the flowmeter open first the inlet valve i.e. pressurize the PD flowmeter and then open slowly the outlet valve.
In this phase loosen the vent screw of the upper cover to remove the air /gas eventually remained into the flowmeter.
Once the upper cover is completely filled with liquid tighten the vent screw and proceed with the start-up.

AVOID TOO HIGH FLOW RATES AS WELL AS TOO SHORT OPENING AND/OR CLOSING CYCLES.



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Start-up and Operating Instructions

4. During initial service periods check frequently the strainer screener, eventually cleaning it, to avoid clogging.
5. PD flowmeters maintain an high accuracy for long periods of time when operated within the flow rate range for which they have been realized. It is recommended to operate the flowmeter only within the flow rate limits specified in the name-plate.
6. In case flowmeters are installed in cold places and especially in case of metering water in such cold places it is recommended, once measuring cycle has been completed, to drain completely, through the proper drain plugs, the liquid remained into the flowmeter to avoid damages to the housing and/or rotors deformations due to liquid (water) freezing.
7. Should the line where PD flowmeter is installed be subject to periodic flushing with high temperature steam and/ or vapor, it is strongly recommended, during the flushing phase, that inner housing ass'y is removed from the outer housing flanged to piping, to avoid that sudden mechanic and thermic shocks may damage the components of the measuring mechanism.



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Failure Analysis

Failures of flowmeter's counter may be caused by:

1. Solid particles inside inner housing ass'y;
2. Rotors interference due to excessive wear of bearings and of timing gears;
3. Failure of coupling ass'y due to excessive wear of transmission gears.
4. Failure of indicator unit.

In case of flowmeter's counter failure it is necessary to inspect the instrument following step by step the inspection procedures listed under item 7 and replacing, where needed, damaged parts with new parts.



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Inspection Procedures

To check the inner housing ass'y it is as first necessary to control whether rotation of timing gears is regular or not.

It is therefore necessary to remove the top cover of PD flowmeter outer housing (see drawing 1) un-screwing the relevant fixing bolts and nuts.

The top cover of outer housing may be removed together with counter unit.

During such an operation particular care must be used to avoid any damage of the "fork type" coupling system existing between the inner housing ass'y and counter unit itself.

Once removed the top-cover, the timing gears of inner housing ass'y may be inspected and their rotation may be checked by hands or with an adequate wrench.

- Should the rotors rotation be normal or uniform it is necessary to check the movement transmission system between inner housing ass'y and counter unit. The transmission system components are integrally mounted with the top-cover and in the actual situation may be easily inspected without particular instructions.
- At contrary, should the rotors rotation be not normal or uniform it is necessary to pull-out the inner housing ass'y from the outer housing to proceed to relevant inspection and maintenance.



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Inner Housing Ass'y Maintenance

The inner housing ass'y is shown in drawing 5 as an ass'y and in drawing 6 as an exploded view.

The numbers printed in the two (2) above mentioned drawings, and which will be referred to hereinafter, are those identifying the componentes listed in the legenda of drawing 6.

To disassembly the rotors it is recommended to proceed in the following way.

1. remove the inner cover (50), timing gears side, taking-out the relevant fixing screws (66).
2. remove the shaped rotors plate (48) taking-out the relevant fixing screws (49). To do that it is necessary to slightly push upward the rotors to avoid that the plate may damage by blowing the centering pins between body and cover (13).
3. mark the relative position of timing gears by making a recognizing sign on them. Such marking is necessary for the correct re-assembly of rotors.
4. pull-out the rotors from inner housing ass'y, using the timing gears as pullers.



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Inner Housing Ass'y Maintenance

Once rotors have been removed the actual conditions of rotors themselves and the wear conditions of timing gears and of bearings may be properly evaluated. It is just the case to mention that the rear cover is disassembled following the same procedures mentioned under item 1).

- **TIMING GEARS**

The purpose of timing gears is to synchronize the rotors and their relative position is established by the centering pins (34). Should timing gears be replaced it is recommended to use particular care in the re-positioning of the new gears. The timing gears are removed by unscrewing the relevant fixing screws (37).

- **BEARINGS**

Should be necessary to replace the bearings (22, 59), those latter must be removed from relevant covers (14, 50), together with the bearing holders (23, 60). To facilitate such an operation it is recommended to mount a screw on the threaded holes of the bearing holders and use them to remove the system bearing/bearing-holder.

Inner housing unit re-assembly procedures are just the reverse of rotors disassembling procedures above mentioned.

However the utmost care and attention must be placed to the following points.



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Inner Housing Ass'y Maintenance

- 1) check and eventually adjust through the screw 40 the distance between the rotors and the bottom cover of measuring unit.
- 2) check that the "clearances", i.e., the distances between the rotors and the distances between those latters and the inner unit body are uniform;
- 3) check that rotor position is that corresponding to the recognizing marks previously made on timing gears.

The PD flowmeter re-assembly procedures are just the reverse of disassembly procedures above mentioned for inner unit ass'y check.

The utmost care must however be put in re-mounting the top-cover to avoid damages to the "fork type" coupling (43, 44, 45) between inner unit ass'y and counter.



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Spare Parts

To order spare parts reference must always be made to the attached exploded-view drawing. (see dwg. 6)

When placing order specify:

- a) flowmeter model, printed on name-plate (see dwg. 1)
- b) flowmeter serial number, printed on name-plate (see dwg. 1)
- c) item number and description of parts as specified in the attached exploded-view drawing (see dwg. 6)

Aprilia, July '01.



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Storage

PD flowmeters are normally supplied packed inside wooden cases that may be easily handled without damaging the instruments.

For cases handling all types of motor machinery and/or hand machinery generally available at storage houses may be used.

It is however recommended to avoid the superimposing of cases except in case of equal dimensions and similar gross weight.

No special precautions have to be taken for short periods of storage. It is however recommended that cases are possibly stored in a closed warehouse and anyway not left in open areas exposed to rain, sand and wind.

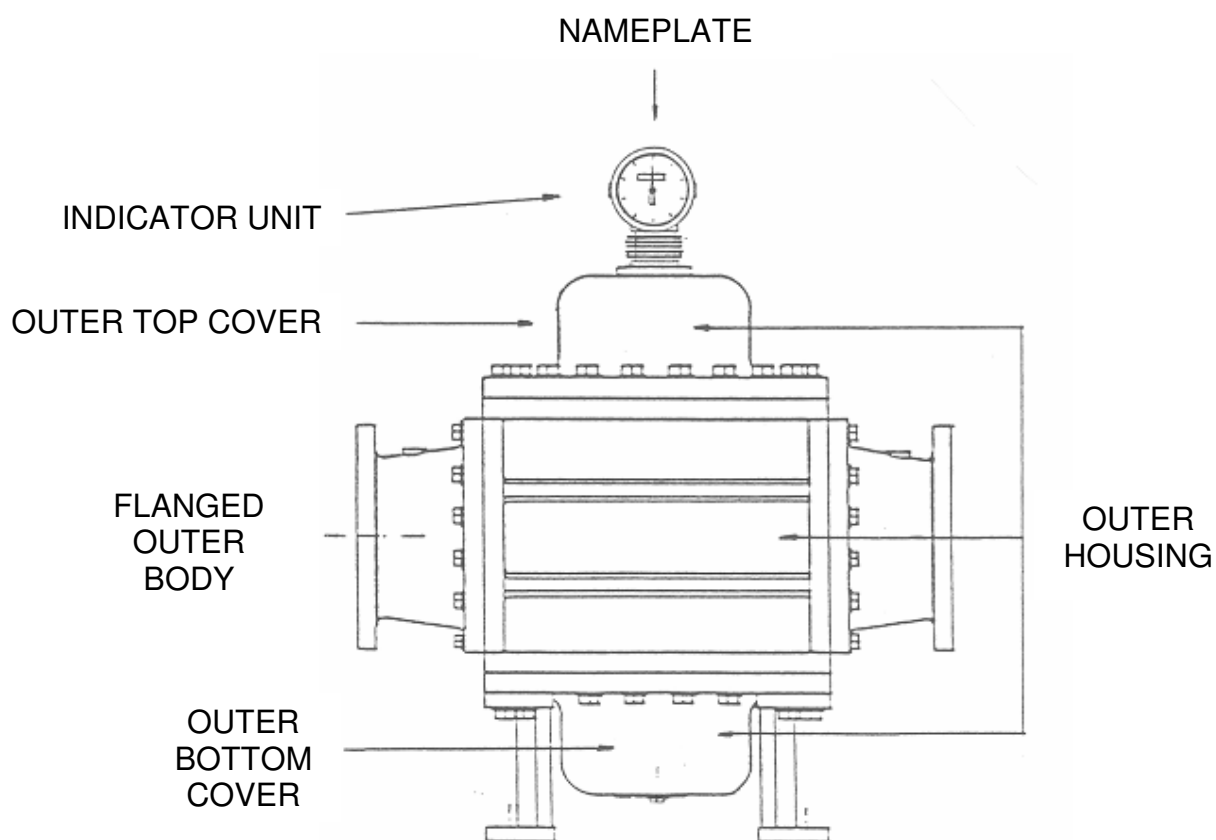
In case of long periods of storage, cases must be stored in a closed warehouse. In addition, PD flowmeters maintenance procedures must be strictly followed immediately after equipment unpacking and/or immediately before their installation and/or start-up.

It is in any case imperative that at least the measuring unit is removed from the outer housing and duly checked according to its specific maintenance procedures, before PD flowmeter start-up.



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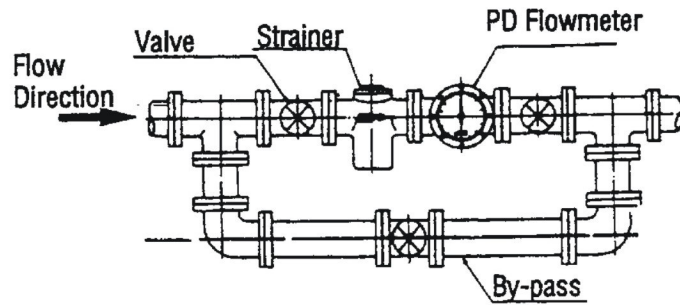
Drawings



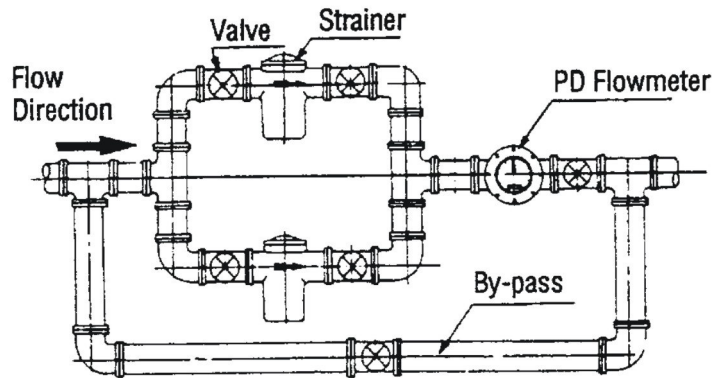
Drawing n.1



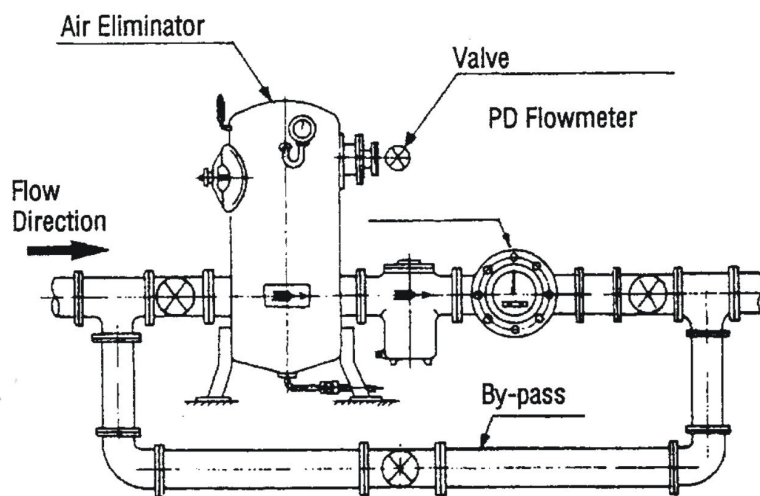
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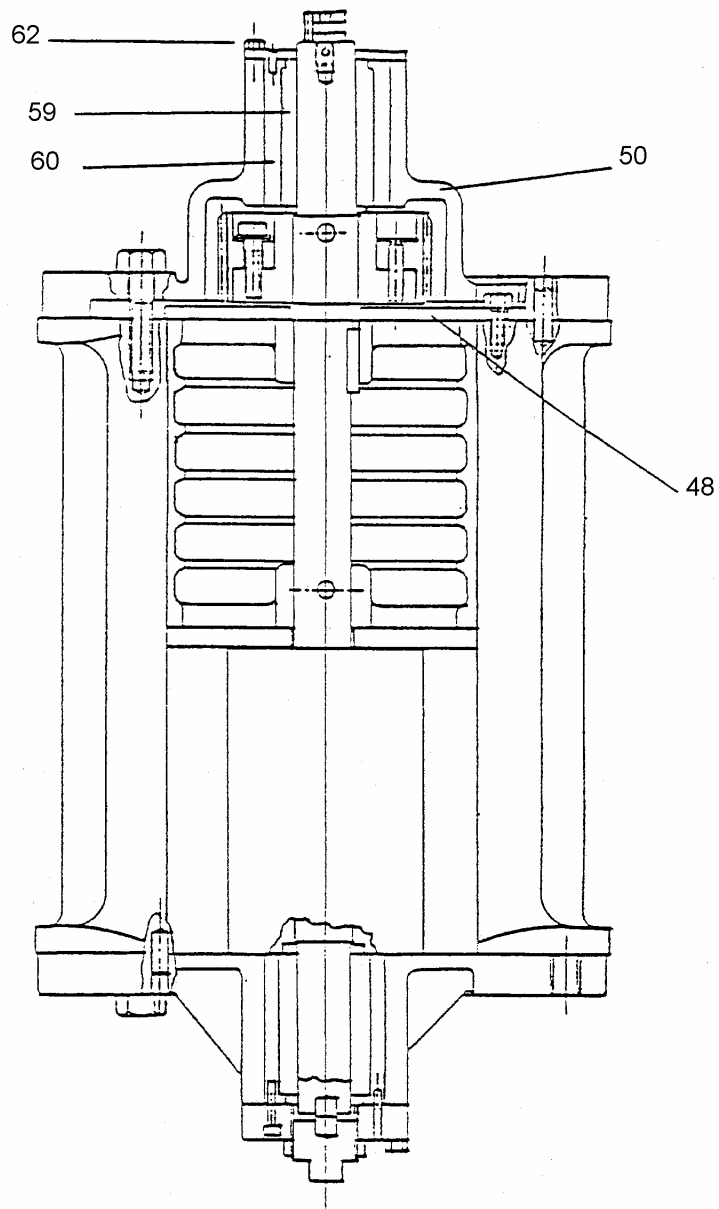
Drawing n.2



Drawing n.3



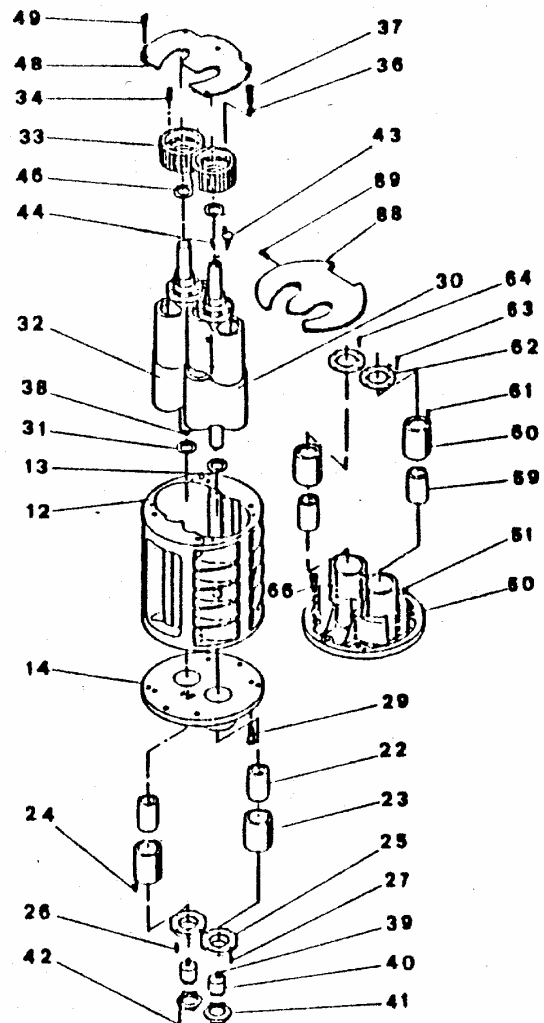
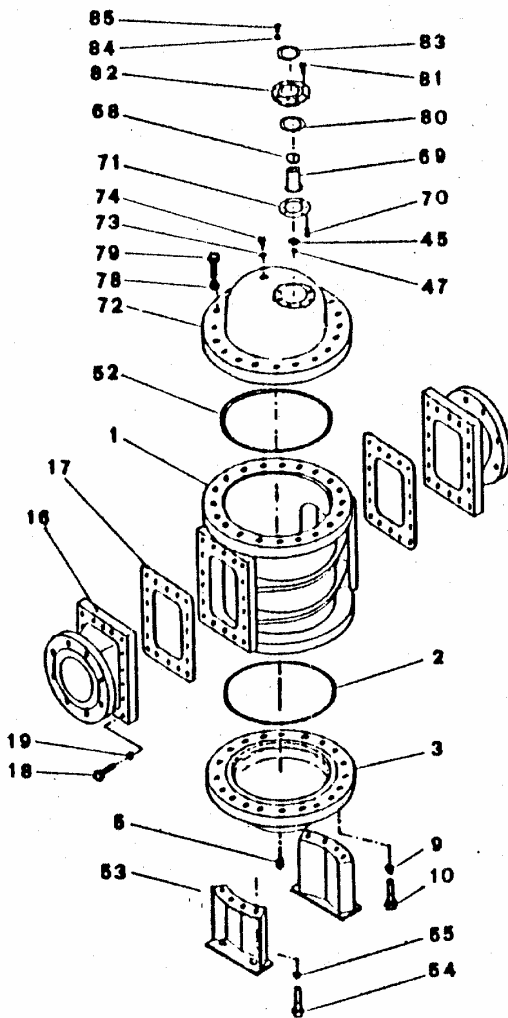
Drawing n.4



Drawing n.5



Spare Parts



Drawing n.6



89	SPINA CONICA	CONIC PIN, ROTOR PLATE	GOUPILLE CONIQUE, PLAQUE ROTORS	6
88	PIATTO SAGOMATO ROTORI	SHAPED ROTOR PLATE	PLAQUE PROFILÉE ROTORS	1
85	BULLONE, SUPP. TEST.	BOLT, COUNTER BASE	BOULON DU SUPPORT DU COMPTEUR	6
84	RONDELLA ELASTICA	SPRING WASHER	SEGMENT DU SUPPORT DU COMPTEUR	16
83	GUARNIZIONE, SUPP. TEST.	GASKET, COUNTER BASE	GARNITURE DU SUPPORT DU COMPTEUR	1
82	FLANGIA, SUPP. TEST.	ADAPTOR, COUNTER	ADAPTEUR DU SUPPORT DU COMPTEUR	1
81	BULLONE, FLANGIA	BOLT, COUNTER BASE	BOULON DU SUPPORT DU COMPTEUR	6
80	GUARNIZIONE, ADATT. TEST.	GASKET, COUNTER BASE	GARNITURE DU SUPPORT DU COMPTEUR	1
79	BULLONE, COPERCHIO	BOLT, COVER	BOULON DU COUVERCLE EXTERNE SUPÉR.	16
78	RONDELLA ELASTICA, COP.	SPRING WASHER, COVER	SEGMENT DU COUVERCLE EXTERNE SUPÉR.	16
74	TAPPO, SFIATO	VENT SCREW	BOUCHON DE DRAINAGE	2
73	GUARNIZIONE, SFIATO	GASKET, VENT	GARNITURE DU DRAINAGE	2
72	COPERCHIO EST. SUPER.	OUTER COVER UP-SIDE	COUVERCLE EXTERNE SUPÉRIOR	1
71	SUPPORTO, TRASMISSIONE	RETAINER, MAGNETIC COUP.	SUPPORT DE LA TRANSMISSION	1
70	BULLONE, TRASMISSIONE	BOLT, MAGNETIC COUPLING	BOULON DE LA TRANSMISSION	8
69	TRASMISSIONE MAGNETICA	MAGNETIC COUPLING ASS'Y	TRANSMISSION MAGNÉTIQUE	1
68	GUARNIZIONE TRASMISSIONE	GASKET, MAGNETIC COUP.	GARNITURE, DE LA TRANSMISSION	1
66	BULLONE, CAMERA MISURA	BOLT, INNER HOUSING	BOULON BOÎTE DE MESURE	4
64	BULLONE, MANICOTTO	BOLT, BUSH	BOULON DU SUPPORT	8
63	BULLONE, SUPPORTO	BOLT, RETAINER	BOULON DU SUPPORT	8
62	SUPPORTO, BOCCOLA	RETAINER, BEARING	SUPPORT DE LA DOUILLE	2
61	SPINA, MANICOTTO	PIN, BUSH	GOUPILLE DE LA DOUILLE	4
60	MANICOTTO, BOCCOLA	BUSH, FRONT BEARING	MANCHON DE LA DOUILLE	2
59	BOCCOLA, SUPERIORE	BEARING, UP-SIDE	DOUILLE SUPÉRIOR	2
55	RONDELLA ELASTICA	SPRING WASHER, BRACKET	SEGMENT ÉTRIER	16
54	BULLONE, STAFFA	BOLT, BRACKET	BOULON DU SUPPORT	8
53	STAFFA APPOGGIO	BRACKET	ÉTRIER	1
52	GUARNIZIONE, CORPO	GASKET BODY	GARNITURE DU CORPS	1
51	SPINA GUIDA, CAM. MIS.	PIN, INNER HOUSING	GOUPILLE GUIDE DE LA BOÎTE DE MESURE	1
50	COPERC. INT. SUPERIORE	INNER END PLATE, UP-SIDE	COUVERCLE INTERNE SUPÉRIOR	1
49	BULLONE, PIATTO SAGOM.	BOLT, SIDE PLATE	BOULON DE LA PLAQUE PROFILÉE	5
48	PIATTO SAGOMATO CHIUS.	SIDE PLATE	PLAQUE PROFILÉE DE FERMETURE	1
47	DADO BLOCC. DISCO TRASM.	LOCK-NUT, TRANSMISSION	ÉCROU, DISQUE DE TRANSMISSION	1
46	ANELLO RASAM., SUPERIORE	THRUST RING, UP-SIDE	BAGUE D'ARRÊT SUPÉRIOR	2
45	DISCO, TRASMISSIONE	COUPLING, DRIVEN	DISQUE DE TRANSMISSION	1
44	GRANO, TRASMISSIONE	DOWEL COUPLING, DRIVING	GOUPILLE DE TRANSMISSION	1
43	FORCHETTA TRASMISSIONE	COUPLING, DRIVING	FOURCHETTE DE TRANSMISSION	1
42	GRANO, GHIERA BULL.	DOWEL NUT ADJUSTER	GOUPILLE DE TRANSMISSION	1
41	GHIERA, BULLONE REG.	NUT ADJUSTER	ÉCROU, DE ENREGISTREMENT	2
40	BULLONE DI REGISTRO	BOLT, ADJUSTER	BOULON DE ENREGISTREMENT	2
39	CILINDRO, SOSTEGNO ROT.	SUPPORT, ROTORS	CYLINDRE SUPPORT ROTORS	2
38	CILINDRO, APPOGGIO ROT.	PLATE BEARING, ROTORS	CYLINDRE PLAQUE ROTORS	2
37	BULLONE, INGRANAGGI	BOLT, TIMING GEAR	BOULON DES ENGRENAGES	16
36	RONDELLA ELAST., INGR.	SPRING WASHER, T. GEAR	SEGMENT DES ENGRENAGES	16
34	SPINA, INGRANAGGI	KNOCK PIN, TIMING GEAR	GOUPILLE DES ENGRENAGES	2
33	INGRANAGGI, SINCRONISMO	TIMING GEAR	ENGRENAGES DE SYNCHRONISME	2
32	ASSIEME ROTORE B	ROOTS ASS'Y B	ENSAMBLE DU ROTOR B	1
31	ANELLO RASAMENTO, INFER.	THRUST RING, BOTTOM	BAGUE D'ARRÊT INFÉRIEUR	2
30	ASSIEME ROTORE A	ROOTS ASS'Y A	ENSAMBLE DU ROTOR A	1
29	BULLONE, CAMERA MISURA	BOLT, INNER HOUSING	BOULON DE LA BOÎTE DE MESURE	4
27	BULLONE, MANICOTTO	BOLT, BUSH	BOULON DU SUPPORT	8
26	BULLONE, SUPPORTO	BOLT, RETAINER	BOULON DU SUPPORT	8
25	SUPPORTO, BOCCOLA INFER.	SUPPORT BOTTOM BEARING	SUPPORT DE LA DOUILLE	2
24	SPINA, MANICOTTO	PIN, BUSH	GOUPILLE DE LA DOUILLE	4
23	MANICOTTO, BOCCOLA	BUSH, REAR BEARING	MANCHON DE LA DOUILLE	2
22	BOCCOLA, INFERIORE	BEARING, BOTTOM	DOUILLE INFÉRIEUR	2
19	ROSETTA ELASTICA	SPRING WASHER, SP. PIPE	SEGMENT, CONNEXION BRIDEE	36
18	BULLONE TRONCHETTO	BOLT, SPOOL PIPE	BOULON, CONNEXION BRIDEE	36
17	GUARNIZIONE TRONCHETTO	GASKET, SPOOL PIPE	GARNITURE, CONNEXION BRIDEE	2
16	TRONCHETTO	SPOOL PIPE	CONNEXION BRIDEE	2
14	COPERCHIO INT. INFER.	INNER END PLATE, BOTTOM	COUVERCLE INTERNE INFÉRIEUR	1
13	SPINA GUIDA CAMERA	PIN, INNER HOUSING	GOUPILLE GUIDE DE LA BOÎTE DE MESURE	4
12	CAMERA DI MISURA	INNER BODY	CORPS DE LA BOÎTE DE MESURE	1
10	BULLONE COPERCHIO	BOLT, COVER	BOULON DU COUVERCLE EXTERNES INFÉR.	16
9	RONDELLA ELAST. COP.	SPRING WASHER, COVER	SEGMENT DU COUVERCLE EXTERNES INFÉR.	16
5	TAPPO, DRENAGGIO	PLUG, DRAIN	BOUCHON DE DRAINAGE	2
4	GUARNIZIONE, DRENAGGIO	GASKET, DRAIN	GARNITURE DU DRAINAGE	2
3	COPERCHIO EST. INFER.	OUTER COVER, BOTTOM	COUVERCLE EXTERNE INFÉRIEUR	1
2	GUARNIZIONE, CORPO	GASKET, BODY	GARNITURE DU CORPS	1
1	CORPO ESTERNO	OUTER BODY	CORPS EXTERNE	1
POS.	DESCRIZIONE	DESCRIPTION	DESCRIPTION	QTY