Doc. No.	NDP 237M-01

MAINTENANCE MANUAL

YAMADA AIR-OPERATED DIAPHRAGM PUMPS

NDP-(P)20B□TU
NDP-(P)25B□TU

⚠ WARNING

- For your own safety, be sure to read these procedures carefully before performing maintenance on this product. After reading this document, be sure to keep it handy for future reference.

This maintenance manual covers what you should know about maintenance of the Yamada NDP-(P)20 series and NDP-(P)25 series Diaphragm Pumps with bonded type TU (PTFE/EPDM) diaphragms.
This edition is based on the standards for the May 2015 production run. Remember the specifications are always subject to change; therefore, some of the information in this edition may not apply to new specifications.

Warnings and Cautions

For safe use of this product, be sure to note the following: In this document, warnings and cautions are indicated by symbols. These symbols are for those who will operate this product and for those who will be **nearby, for safe operation and for prevention of personal injury and property damage. The following warning** and caution symbols have the meanings described below. Be sure to remember their meanings.

⚠ WARNING :	If you ignore the warning described and operate the product in an improper manner, there is danger of serious bodily injury or death.
⚠ CAUTION :	If you ignore the caution described and operate the product in an improper manner, there is danger of personal injury or property damage.

Furthermore, to indicate the type of danger and damage, the following symbols are also used along with those mentioned above:

This symbol indicates a DON'T, and will be accompanied by an explanation on something you must not do.

This symbol indicates a DO, and will be accompanied by instructions on something you must do in a certain situation.

⚠ WARNING

Before starting maintenance work, cut off the feed air and clean the pump. If air pressure or residue remain in the pump, there is danger of explosion, or possible poisoning resulting in serious injury or death if chemicals adhere to the skin or are accidentally swallowed.
(For details on cleaning the pump, refer to Chapter 6 of the operating manual.)

When replacing parts, be sure to use the recommended genuine parts or equivalents. Use of other parts may cause a malfunction of the product.
(Refer to Exploded View and Reminder to order correct item on the separate sheets.)

⚠ CAUTION

When it is instructed that special tools must be used, be sure to use the specified tools. Otherwise, the pump may be damaged.

Refer to 10.1 "Specifications" in the Operation Manual. Also, remember that the pumps is heavy, and extreme care must be taken when lifting it.

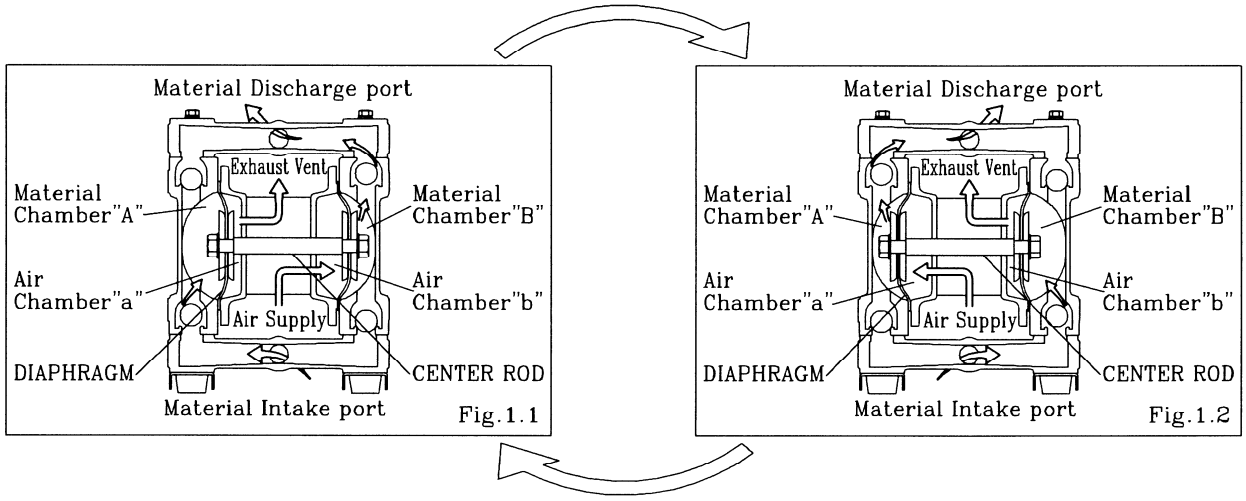
Table of Contents

1. Principles of operation

There are two diaphragms fixed to the center rod, one at each end. When compressed air is supplied to air chamber b (right side, see Fig.1.1), the center rod moves to the right, the material in material chamber B is pushed out, and at the same time material is sucked into material chamber A.

When the center rod is moved full-stroke to the right, the air switch valve is switched, compressed air is sent to air chamber a (left side, see Fig.1.2), and the center rod moves to the left. The material in material chamber A is pushed out, and at the same time material is sucked into material chamber B.

Through repetition of this operation, material is repeatedly taken in and discharged out.



2. Tools, etc.

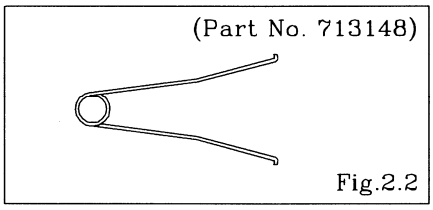
2.1 General tools

·Socket wrenches	10mm, 12mm, 13mm, 17mm, 22mm
·Hexagonal box wrenches	5mm
·Open-end wrenches	13mm (BP□, BV□), 22mm (BA□[-D], BS□, BF□)
·Adjustable wrench	(Models with PP motor)
·Phillips head screw driver	(Models with PP motor)

2.2 Special tools

·Sleeve remover (sold separately)

Purpose: For removing sleeves



2.3 Misc.

·Assembly oil	Turbine oil none addition class 1(equivalent to ISO VG32 grade)
·Nuts	M14×1.5
·Grease	Urea grease grade (NLGI) No. 2
·Lubricants	Equivalent to LOCTITE ANTI-SEIZE 767

3. Ordering Replacement parts

For accurate and speedy shipment of parts, be sure to order the right parts for your model to distributor. Indicate the part numbers, descriptions, and quantities.

4. Balls and Valve seats

4.1 Removal

■BA□[-D], BS□, BF□ types

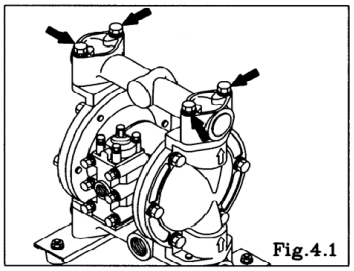


Fig.4.1

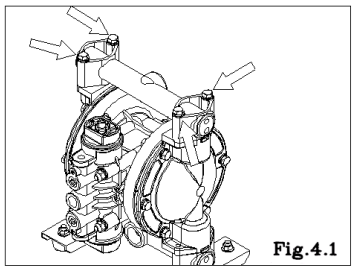


Fig.4.1

▪ Remove the 4 retainer bolts from the out manifold, and remove the out manifold. [Fig.4.1]

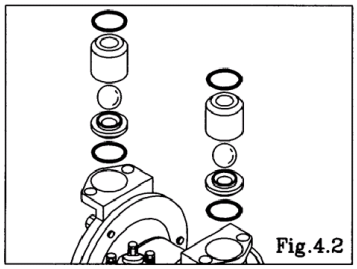


Fig.4.2

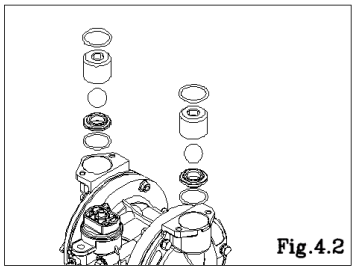


Fig.4.2

▪ Remove the O ring, valve stopper, ball and valve seat. [Fig.4.2]

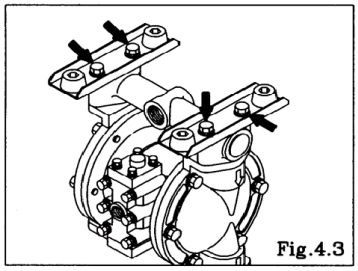


Fig.4.3

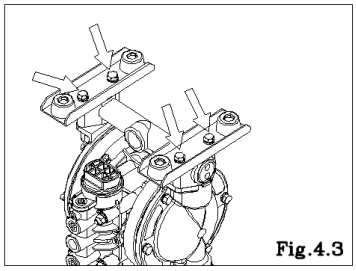


Fig.4.3

▪ Turn over the main body assembly. [Fig.4.3]
▪ Remove the 4 retainer bolts from the in manifold, and remove the in manifold and pump bases. [Fig.4.3]
(The pump bases are not installed in BA□-D types.)

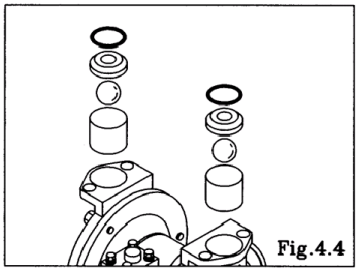


Fig.4.4

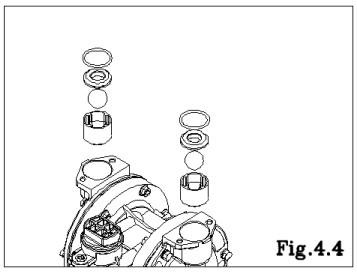


Fig.4.4

▪ Remove the O ring, valve seat, ball and valve stopper. [Fig.4.4]

■BP□, BV□ types

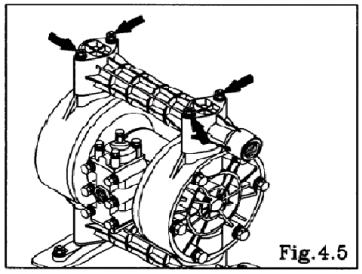


Fig.4.5

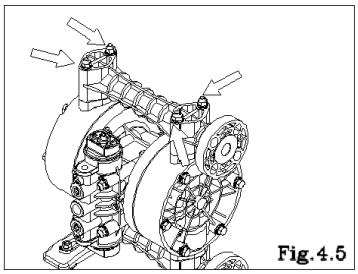


Fig.4.5

- Remove the 4 retainer nuts from the upper side of tie rods, and remove the out manifold. [Fig.4.5]
  <NOTE>
- When the 4 retainer nuts of the tie rod are removed, you can take of the out manifold.

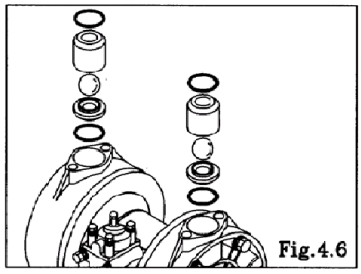


Fig.4.6

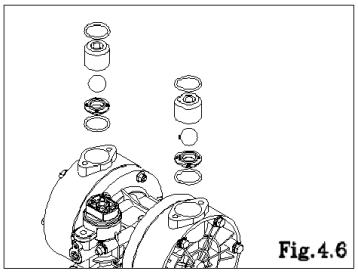


Fig.4.6

- Remove the O ring, valve stopper, ball and valve seat. [Fig.4.6]

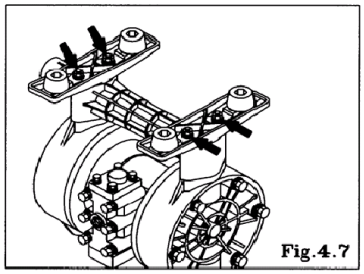


Fig.4.7

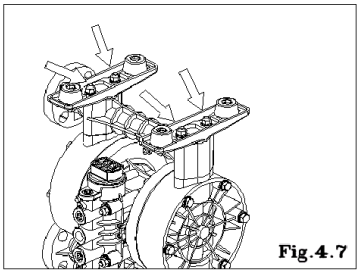


Fig.4.7

- Turn over the main body assembly. [Fig.4.7]
- Pull out the 4 tie rods.
  Remove the bases and in manifold. [Fig.4.7]

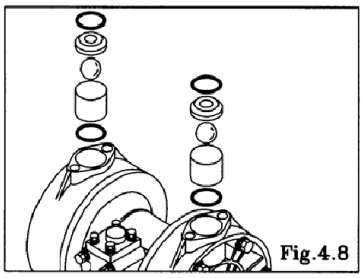


Fig.4.8

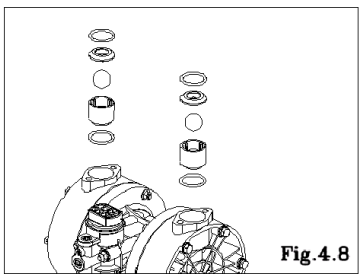


Fig.4.8

- Remove the O ring, valve seat, ball and valve stopper. [Fig.4.8]

4.2 Inspection

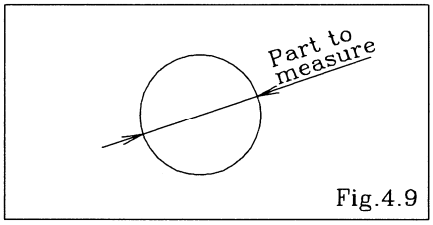


Fig.4.9

▪ Ball [Fig.4.9]
Measure the outside diameter, and if it is outside the usable range, replace the ball.

Usable range of Ball

NDP-20	SØ24.3 ~ SØ27.8 mm
NDP-25	SØ31.5 ~ SØ36.1 mm

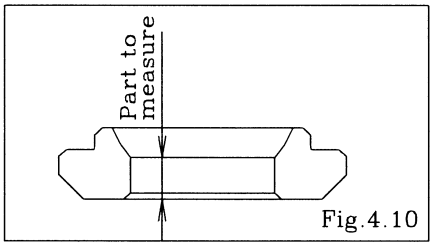


Fig.4.10

▪ Valve seat [Fig.4.10]
Measure the dimension shown at left, and if it is outside the usable range, replace the valve seat.

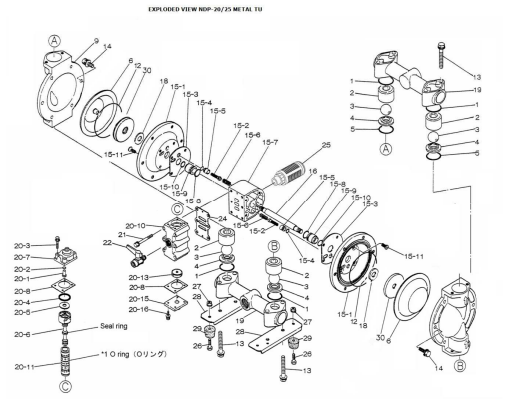
Usable range of Valve seat

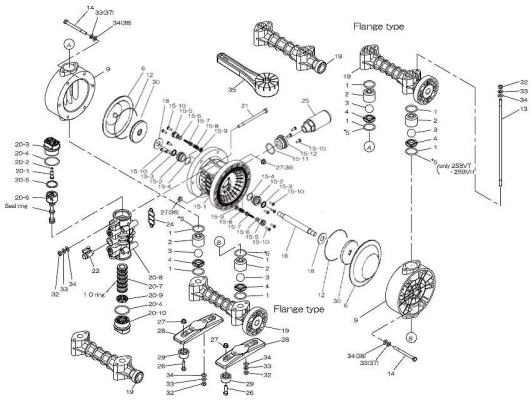
	BA□, BS□	BP□, BV□
NDP-20	3.4 ~ 8.5 mm	3.3 ~ 8.1 mm
NDP-25	3.8 ~ 9.5 mm	3.4 ~ 9.5 mm

▪ O ring (other than PTFE)
If O rings are worn out or cracked, replace them.

4.3 Installation

For installation, see [Exploded View] on the separate sheet and install in the reverse order of disassembly.





Tightening torque for manifold retainer bolts

		TU
NDP-(P)20	BATU	20 N・m
	BSTU	
NDP-(P)25	BATU	35 N・m
	BSTU	
	BFTU	

Tightening torque for manifold retainer nuts

		TU
NDP-(P)20	BPTU	12 N・m
NDP-(P)25	BPTU	
	BVTU	

<NOTE>

- Make sure there is no dust on the seal surface and the seal is not damaged.
- Replace the PTFE O ring regardless of its condition.

5. Diaphragm TU and Center rod

5.1 Removal

■BATU[-D], BSTU, BFTU, BPTU, BVTU types

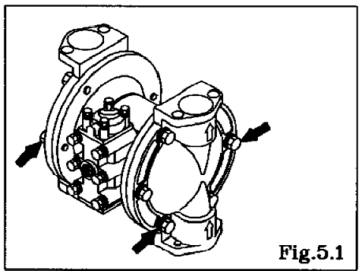


Fig.5.1

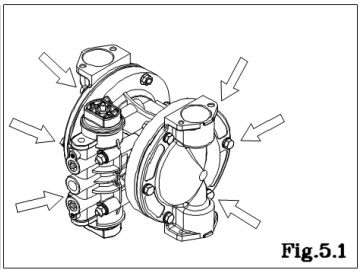


Fig.5.1

- Metal pumps:
  Remove the ball and valve seat etc.
  (see [4.1 Removal)
- Remove the 12 retainer bolts from the out chamber, and remove the out chamber. [Fig.5.1]

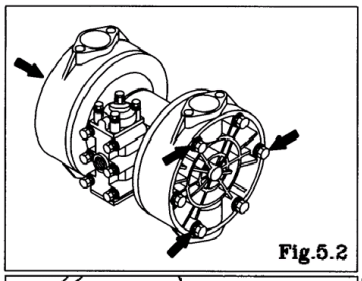


Fig.5.2

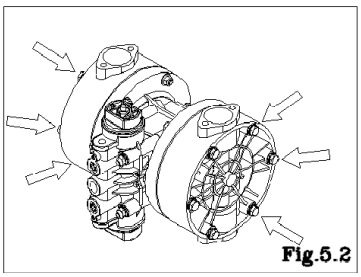


Fig.5.2

- Plastic pumps:
  Remove the ball and valve seat etc.
  (see [4.1 Removal)
- Remove the 12 retainer bolts from the out chamber, and remove the out chamber. [Fig.5.2]

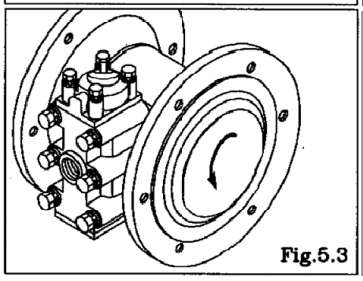


Fig.5.3

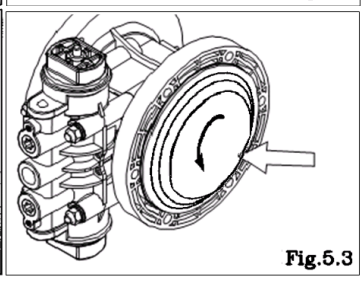


Fig.5.3

- Remove pump chamber both side to have access to the TU diaphragms. [Fig.5.3]
- Secure on 1 side the TU diaphragm by hand, and start to unscrew the diaphragm the other side.
  Remove the center disk and cushion.
  Pull out the center rod with diaphragm, center disk and cushion from the other side.

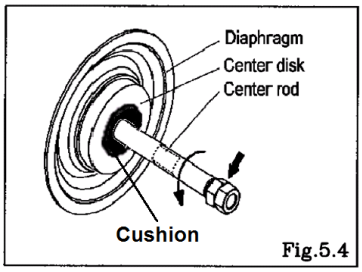


Fig.5.4

- Remove the center rod with diaphragm, center disk and cushion from the other side.
  Pull out the center rod with diaphragm, center disk and cushion from the other side.
- Remove the diaphragm center disk on the opposite side using the double nut. [Fig.5.4]
  Using a vise with soft metal plates is also allowed.

5.2 Inspection

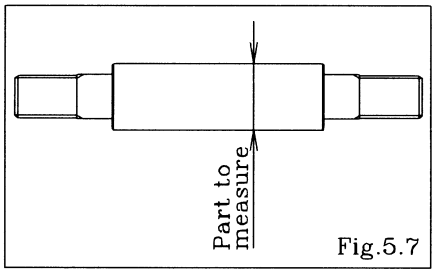


Fig.5.7

- Diaphragm
  If the diaphragm is worn out or damaged, replace it.
  Always replace diaphragms on both sides.

Guideline of diaphragm life

PTFE&EPDM **TU**	20,000,000 cycle

(When used with clean water at room temperature and max test pressure 5Bar)

- Center rod [Fig.5.7]
  Measure the diameter, and if it is outside the usable range, replace the center rod.

Usable range of center rod

Ø 17.9 ~ Ø18.0 mm

5.3 Installation BONDED TYPE PTFE/EPDM "TU"

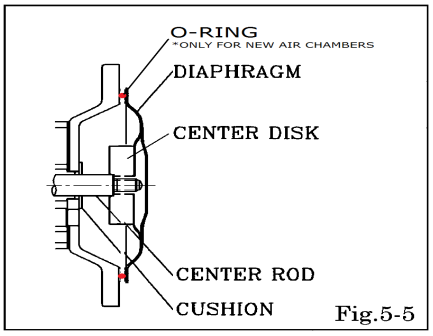


Fig.5-5

・Apply urea grease to the center rod and throat bearing, and insert it into the main body.
・Install the cushions, center disks and TU diaphragms. screw the diaphragms hand tight.
・**For PP motor and new aluminum air chambers, Install between diaphragm and air chambers the big O-ring** (Fig 5.5)

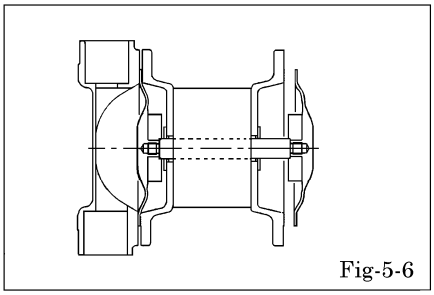


Fig-5-6

・Push the diaphragm on 1 side against the air chamber, and install the out chamber.
Tighten the bolts temporarily crosswise. [Fig.5.6]

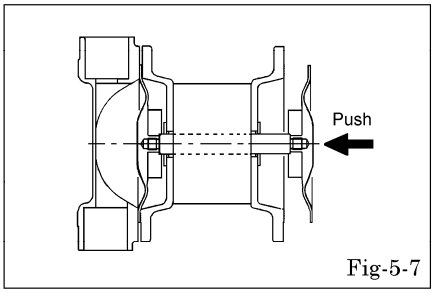


Fig-5-7

・Push the diaphragm of opposite side against the air chamber [Fig.5.7]

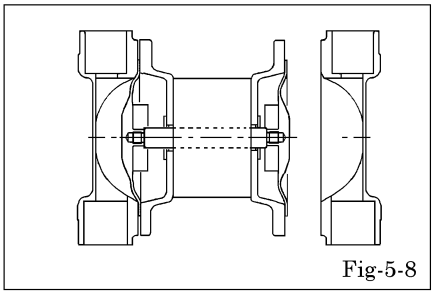


Fig-5-8

・Install the second out chamber.
Tighten the bolts temporarily crosswise. [Fig.5.8]
・After installation of the out chambers on both sides, place the pump on a flat surface and stand the pump upright for further assembly.

Tightening torque for out chamber.

		TU
NDP-20	BA/BS	13N·m{130kgf·cm}
	BP	
NDP-25	BA/BS/BF	20N·m{200kgf·cm}
	BP	
	BV	

<NOTE>
・Make sure there is no dust on the seal surface in order to prevent seal damaged.
・Tighten the bolts that balance should be equal from both side on diagonal line with even torque.
・Torque always first the out chambers before manifolds.

6. Throat bearing and Pilot valve Assembly aluminum motor

6.1 Removal

- Remove the diaphragm and center rod. see 5.1 Removal.
- For aluminum motor, remove the 8 retainer bolts (4 on each side) from the separate air chambers. Remove both chambers and gaskets. [Fig.6.1A]
- For PP motor remove the 10 retainer screws (5 on each side)from the body. [Fig.6.1B] The PP motor has no separate air chambers.
- Pull out the pilot valve assembly. [Fig.6.2 A]
- Pull out the throat bearing assembly. [Fig.6.2 B]

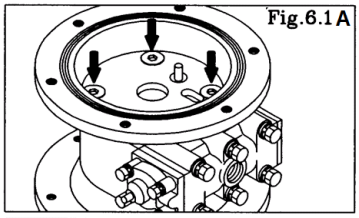


Fig.6.1A

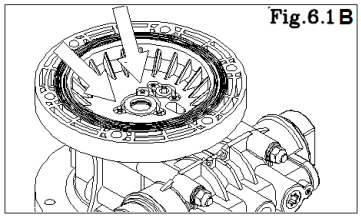


Fig.6.1B

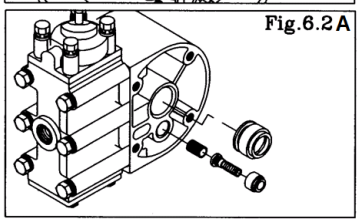


Fig.6.2A

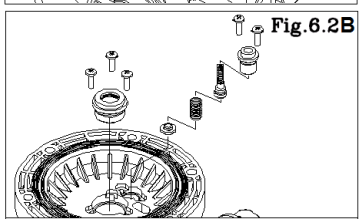


Fig.6.2B

- Remove the packing from the throat bearing. [Fig.6.3]

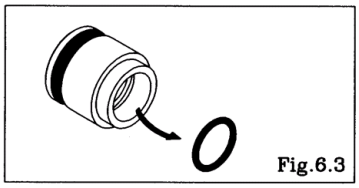


Fig.6.3

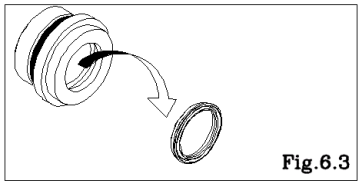


Fig.6.3

6.2 Inspection

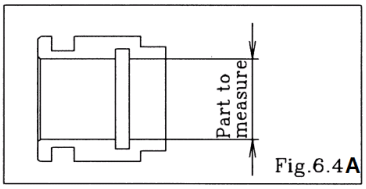


Fig.6.4A

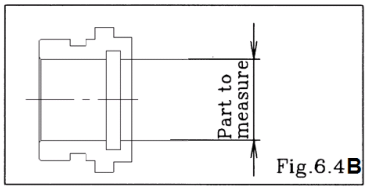


Fig.6.4B

- Throat bearing aluminum motor [Fig.6.4A]
  Throat bearing PP motor [Fig.6.4B]
  Measure the inside diameter, and if it is outside the usable range, replace the throat bearing.

Usable range of throat bearing

Ø 18.03 ~ Ø 18.14 mm

- O rings, V-Packing
  If the O ring is worn out, cracked or chemical attacked, replace it.
- Pilot valve assembly
  If the pilot valve is worn out or cracked, replace it.
  If the O-ring is chemical attacked, replace it.

6.3 Installation

For installation, see [Exploded View] on the separate sheet and install in the reverse order of disassembly.

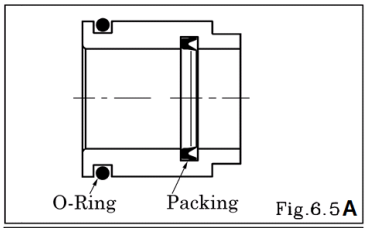


Fig.6.5A

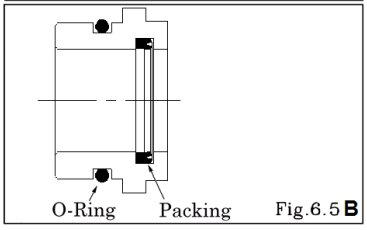


Fig.6.5B

Tightening torque for aluminum air chamber retainer bolts

18 N・m

Tightening torque for retainer screws pp air motor

2 N・m

<NOTE>

- Make sure there is no dust on the seal surface and the seal is not damaged.
- Apply urea grease to packing.
  Specific for PP motor,
- At first, tapping screw is tighten by hand and use Phillips head screw driver.
- Do not tighten the tapping screws too much. (Be careful when power tool is used.)

7. C Spool Valve Assembly and Sleeve Assembly

7.1 Removal

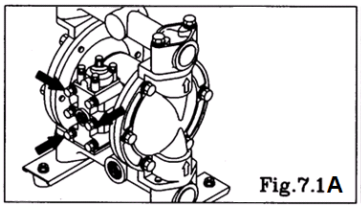


Fig.7.1A

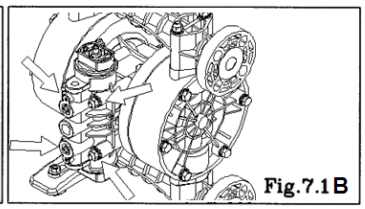


Fig.7.1B

▪ Aluminum motor: remove the 6 retainer bolts from the valve body, and remove the valve body including gasket. [Fig.7.1A]

▪ PP motor: remove the 4 retainer bolts from the valve body, and remove the valve body including gasket. [Fig.7.1B]

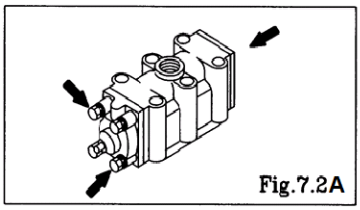


Fig.7.2A

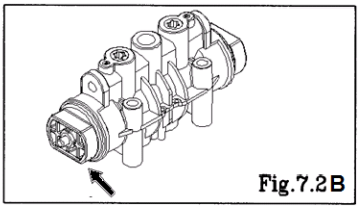


Fig.7.2B

▪ Aluminum motor: remove the 4 bolts cap A and 4 bolts cap B. Remove cap A, cap B, packing, plain washer, cushion and gasket. [Fig.7.2A] Pull out the C-spool assembly.

▪ PP motor: Remove the cap A with adjustable spanner. Remove packing and pull out the C spool valve assembly. [Fig.7.2B]

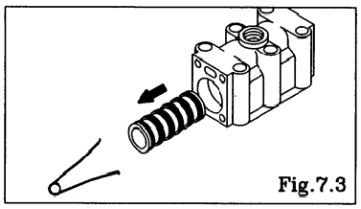


Fig.7.3

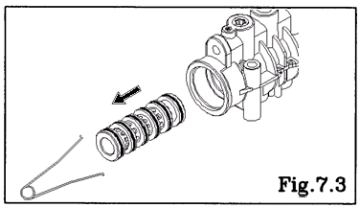


Fig.7.3

▪ Remove the sleeve using the sleeve remover (special tool: Part number 713148). [Fig.7.3]

7.2 Inspection

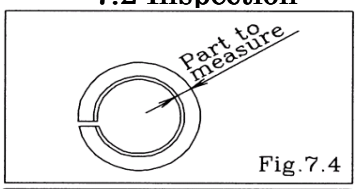


Fig.7.4

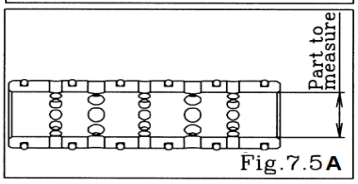


Fig.7.5A

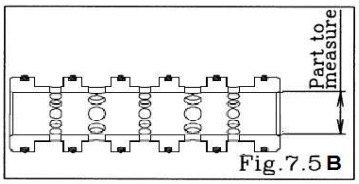


Fig.7.5B

▪ C Spool Valve Assembly
Seal ring [Fig.7.4]
Measure the inside thick diameter, and if it is outside the usable range, replace the C Spool Valve Assembly. If the seal ring is worn out or cracked, replace C Spool Valve Assembly.

Usable range of Seal ring

2.94 ~ 3.02 mm

▪ Sleeve Assembly [Fig.7.5]
Measure the inside diameter, and if it is outside the usable range, replace the sleeve assembly.

Usable range of Sleeve

Ø 18.63 ~ Ø 18.65 mm

▪ O rings
If the O ring is worn cracked or chemical attacked, replace them.

<NOTE>

▪ C Spool Valve Assembly and Sleeve Assembly must be replaced complete set. Unable to replace individual component

7.3 Installation

For installation, see [Exploded View] on the separate sheet and install in the reverse order of disassembly.

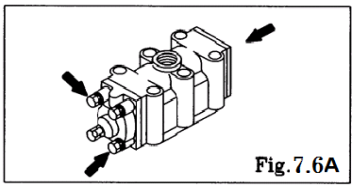


Fig.7.6A

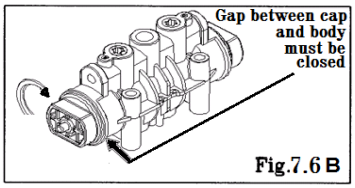


Fig.7.6B

Alu motor Tightening torque for installation Cap A, Cap B

6 N•m (Fig 7.6A)

PP motor, valve body cap must be screwed inside with an adjustable wrench hand tight. (Fig 7.6B)

Tightening torque for Valve body installation bolts

7.5 N•m

<NOTE>

▪ Make sure there is no dust on the seal surface and it is not damaged.

▪ Install the sleeve at the center of the valve body. At this point, apply lubricating oil around the sleeve and O ring.

8. Retightening of Tie rods

■ Metal type

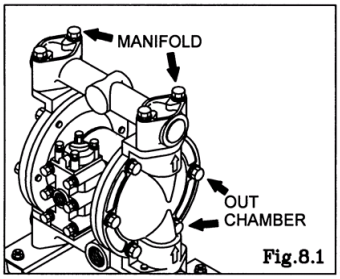


Fig.8.1

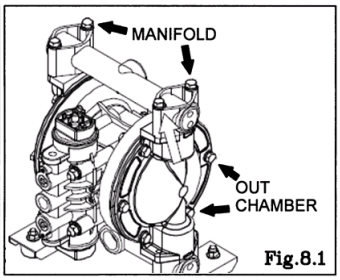


Fig.8.1

▪ The torque should be applied on the occasion of
(1) Right before the pump to use.
(2) There are any leaks of material on daily inspecting a pump.

		Retainer bolts from the out chamber	Retainer bolts from the manifold
NDP-(P)20	BATU / BSTU	13 N・m	20 N・m

		Retainer bolts from the out chamber	Retainer bolts from the manifold
NDP-(P)25	BATU / BFTU / BSTU	20 N・m	35 N・m

<NOTE>
▪ Tighten the bolts that balance should be equal (cross wise) from both side on diagonal line with even torque.
▪ Retighten firstly the Out chamber bolts and then the manifold bolts. Always in this order. [Fig.8.1]

■ Plastic type

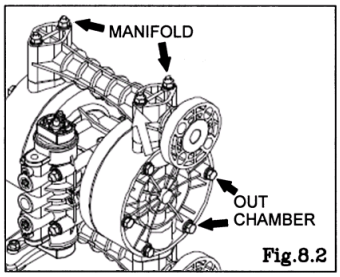


Fig.8.2

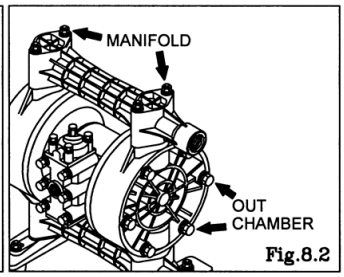


Fig.8.2

▪ The torque should be applied on the occasion of
(1) Right before the pump to use.
(2) There are any leaks of material on daily inspecting a pump.

		Retainer bolts from the out chamber	Retainer bolts from the manifold
NDP-(P)20	BPTU	13 N・m	12 N・m

		Retainer bolts from the out chamber	Retainer bolts from the manifold
NDP-(P)25	BPTU, BVTU	20 N・m	12 N・m

<NOTE>
▪ Tighten the bolts that balance should be equal from both side on diagonal line with even torque.
▪ Retighten the Out chamber and then the manifold in this order. [Fig.8.2]

Manufactured by

YAMADA EUROPE B.V.

Aquamarijnstraat 50, 7554 NS Hengelo(O) The Netherlands
Phone: 0031 (0)74 2422032　Fax: 0031 (0)74 2421055
E-mail　sales@yamada-europe.com

YAMADA CORPORATION

INTERNATIONAL DEPARTMENT
No.1-3, 1-Chome, Minami- Magome, Ohta-Ku, Tokyo, 143-8504, Japan
Phone: 0081-(0)3-3777-0241 Fax: 0081-(0)3-3777-0584

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