

9. Handling of the Bearing Unit

9.1 Mounting of the housing

9.11 Pillow block type and flange type

Although an advantage of the NTN bearing unit is that it can be fitted easily and will function efficiently on any part of a machine, attention must be paid to the following points in order to ensure its normal service life.

- 1) The surface on which the housing is mounted must be sufficiently rigid.
- 2) The surface on which the housing is mounted should be as flat as possible (The housing should set firmly in its position). Deformation of the housing caused by incorrect mounting will in turn cause deformation of the bearing, leading to its premature breakdown.

- 4) The pillow block type and flange type housings are provided with a seat for a dowel for accurate location. For the use of dowel pins, refer to Table 9.1.

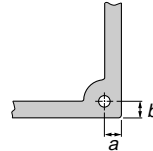


Table 9.1 Recommended dimensions of dowel pins

Designation of the housings	a		b		Recommended pin diameter		
	mm	inch	mm	inch	mm	inch	
P203	—		5.5	0.216	3	0.118	
P204	C-P204	5.5	0.216	5.5	0.216	3	0.118
P205	C-P205	5.5	0.216	5.5	0.216	3	0.118
P206	C-P206	5.5	0.216	5.5	0.216	3	0.118
P207	C-P207	5.5	0.216	5.5	0.216	3	0.118
P208	C-P208	7	0.276	7	0.276	5	0.197
P209	C-P209	7	0.276	7	0.276	5	0.197
P210	C-P210	7.5	0.295	7.5	0.295	5	0.197
P211	C-P211	7.5	0.295	7.5	0.295	5	0.197
P212	C-P212	9	0.354	9	0.354	7	0.276
P213	C-P213	9	0.354	9	0.354	7	0.276
P214	C-P214	9	0.354	9	0.354	7	0.276
P215	C-P215	9	0.354	9	0.354	7	0.276
P216	C-P216	10	0.394	10	0.394	7	0.276
P217	C-P217	12	0.472	12	0.472	10	0.394
P218	C-P218	12	0.472	12	0.472	10	0.394
P305	C-P305	8	0.315	8	0.315	4	0.157
P306	C-P306	8	0.315	8	0.315	4	0.157
P307	C-P307	10	0.394	10	0.394	5	0.197
P308	C-P308	10	0.394	10	0.394	5	0.197
P309	C-P309	10	0.394	10	0.394	5	0.197
P310	C-P310	12	0.472	12	0.472	6	0.236
P311	C-P311	12	0.472	12	0.472	6	0.236
P312	C-P312	14	0.551	14	0.551	6	0.236
P313	C-P313	14	0.551	14	0.551	6	0.236
P314	C-P314	14	0.551	14	0.551	6	0.236
P315	C-P315	17	0.669	17	0.669	8	0.315
P316	C-P316	17	0.669	17	0.669	8	0.315
P317	C-P317	17	0.669	17	0.669	8	0.315
P318	C-P318	17	0.669	17	0.669	8	0.315
P319	C-P319	17	0.669	17	0.669	8	0.315
P320	C-P320	17	0.669	17	0.669	8	0.315
P321	C-P321	17	0.669	17	0.669	8	0.315
P322	C-P322	19	0.748	19	0.748	10	0.394
P324	C-P324	19	0.748	19	0.748	10	0.394
P326	C-P326	23	0.906	23	0.906	12	0.472
P328	C-P328	23	0.906	23	0.906	12	0.472

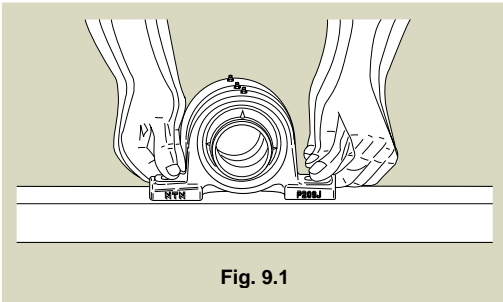


Fig. 9.1

- 3) It is desirable that the angle between the surface on which the housing is mounted and the shaft be maintained to a tolerance of $\pm 2^\circ$.

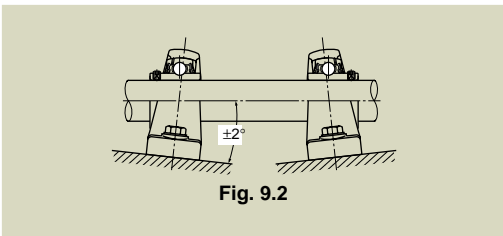


Fig. 9.2

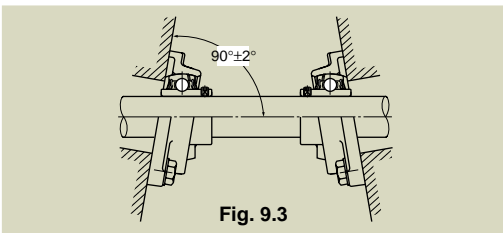
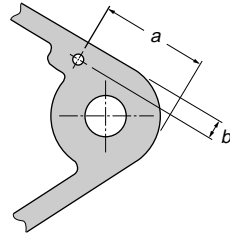
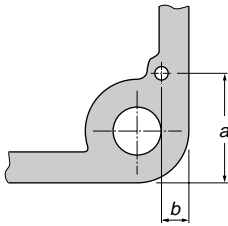


Fig. 9.3

Technical Data



Designation of the housings		a		b		Recommended pin diameter	
		mm	inch	mm	inch	mm	inch
F204	C-F204	33	1.299	6	0.236	4	0.157
F205	C-F205	35	1.378	6	0.236	4	0.157
F206	C-F206	35	1.378	6	0.236	4	0.157
F207	C-F207	38	1.496	7	0.276	5	0.197
F208	C-F208	40	1.575	8	0.315	5	0.197
F209	C-F209	43	1.693	8	0.315	5	0.197
F210	C-F210	49	1.929	8	0.315	5	0.197
F211	C-F211	49	1.929	8	0.315	5	0.197
F212	C-F212	49	1.929	8	0.315	5	0.197
F213	C-F213	52	2.047	9	0.354	6	0.236
F214	C-F214	52	2.047	9	0.354	6	0.236
F215	C-F215	52	2.047	9	0.354	6	0.236
F216	C-F216	55	2.165	12	0.472	6	0.236
F217	C-F217	55	2.165	12	0.472	6	0.236
F218	C-F218	61	2.402	14	0.551	6	0.236
F305	C-F305	35	1.378	6	0.236	4	0.157
F306	C-F306	40	1.575	6	0.236	4	0.157
F307	C-F307	47	1.850	8	0.315	5	0.197
F308	C-F308	48	1.890	8	0.315	5	0.197
F309	C-F309	48	1.890	8	0.315	5	0.197
F310	C-F310	48	1.890	8	0.315	5	0.197
F311	C-F311	51	2.008	10	0.394	5	0.197
F312	C-F312	51	2.008	10	0.394	5	0.197
F313	C-F313	57	2.244	10	0.394	6	0.236
F314	C-F314	61	2.402	10	0.394	6	0.236
F315	C-F315	65	2.559	8.5	0.335	6	0.236
F316	C-F316	65	2.559	8.5	0.335	6	0.236
F317	C-F317	70	2.756	9	0.354	6	0.236
F318	C-F318	80	3.150	10	0.394	8	0.315
F319	C-F319	80	3.150	10	0.394	8	0.315
F320	C-F320	80	3.150	10	0.394	8	0.315
F321	C-F321	80	3.150	10	0.394	8	0.315
F322	C-F322	90	3.543	10	0.394	8	0.315
F324	C-F324	90	3.543	13	0.512	10	0.394
F326	C-F326	100	3.937	13	0.512	10	0.394
F328	C-F328	108	4.252	13	0.512	10	0.394

Designation of the housings		a		b		Recommended pin diameter	
		mm	inch	mm	inch	mm	inch
FL204	C-FL204	22	0.866	10	0.394	4	0.157
FL205	C-FL205	28	1.102	10	0.394	4	0.157
FL206	C-FL206	33	1.299	12	0.472	4	0.157
FL207	C-FL207	30	1.181	14	0.551	5	0.197
FL208	C-FL208	33	1.299	15	0.591	5	0.197
FL209	C-FL209	38	1.496	15	0.591	5	0.197
FL210	C-FL210	39	1.535	16	0.630	5	0.197
FL211	C-FL211	44	1.732	18	0.709	5	0.197
FL212	C-FL212	54	2.126	19	0.748	5	0.197
FL213	C-FL213	53	2.087	18	0.709	6	0.236
FL214	C-FL214	53	2.087	18	0.709	6	0.236
FL215	C-FL215	55	2.165	21	0.827	6	0.236
FL216	C-FL216	55	2.165	21	0.827	6	0.236
FL217	C-FL217	55	2.165	21	0.827	6	0.236
FL218	C-FL218	55	2.165	22	0.866	6	0.236
FL305	C-FL305	35	1.378	9	0.354	4	0.157
FL306	C-FL306	44	1.732	11	0.433	4	0.157
FL307	C-FL307	43	1.693	13	0.512	5	0.197
FL308	C-FL308	45	1.772	15	0.591	5	0.197
FL309	C-FL309	51	2.008	18	0.709	5	0.197
FL310	C-FL310	55	2.165	15	0.591	5	0.197
FL311	C-FL311	55	2.165	15	0.591	5	0.197
FL312	C-FL312	60	2.362	18	0.709	5	0.197
FL313	C-FL313	59	2.323	24	0.945	6	0.236
FL314	C-FL314	63	2.480	24	0.945	6	0.236
FL315	C-FL315	66	2.598	23	0.906	6	0.236
FL316	C-FL316	72	2.835	27	1.063	6	0.236
FL317	C-FL317	74	2.913	29	1.142	6	0.236
FL318	C-FL318	74	2.913	29	1.142	8	0.315
FL319	C-FL319	80	3.150	30	1.181	8	0.315
FL320	C-FL320	84	3.307	30	1.181	8	0.315
FL321	C-FL321	84	3.307	30	1.181	8	0.315
FL322	C-FL322	84	3.307	36	1.417	8	0.315
FL324	C-FL324	93	3.661	38	1.496	10	0.394
FL326	C-FL326	94	3.701	39	1.535	10	0.394
FL328	C-FL328	102	4.016	40	1.575	10	0.394

9.1.2 Cartridge type

The inside diameter of the housing into which a cartridge type unit is inserted should be H7 under general operating conditions. It should be so furnished as to permit the bearing unit to move freely in the axial direction.

9.2 Mounting the bearing unit on the shaft

9.2.1 Mounting of the set screw system unit

To mount the set screw system bearing unit on the shaft, it is sufficient to tighten the two set screws uniformly.

The construction of the NTN "Ball-End Set Screw" is illustrated in Fig. 9.4 with the pin design that prevents it from becoming loose even when it is subjected to vibrations or impact loads.

If the fit clearance between the inner ring and the shaft is very small, it is advisable, prior to fastening on the screw, to file off that part of the shaft at which the end of the set screw (ball) strikes, by approximately 0.2 to 0.5 mm (0.01 to 0.02 inches), to flatten it, as illustrated in Fig. 9.5.

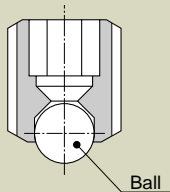


Fig. 9.4

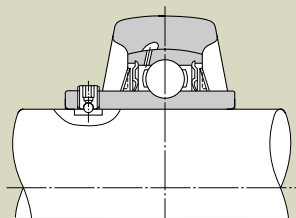


Fig. 9.5

This will facilitate dismantling of the bearing from the shaft should it become necessary.

The method of mounting the unit on the shaft is as follows:

- 1) Make certain that the end of the set screw is not protruding into the bore of the bearing.
- 2) Holding the unit at right angles to the shaft, insert the shaft into the bore of the bearing without twisting the bearing. Take care not to strike the slinger nor to subject the unit to any shock (Fig. 9.6).

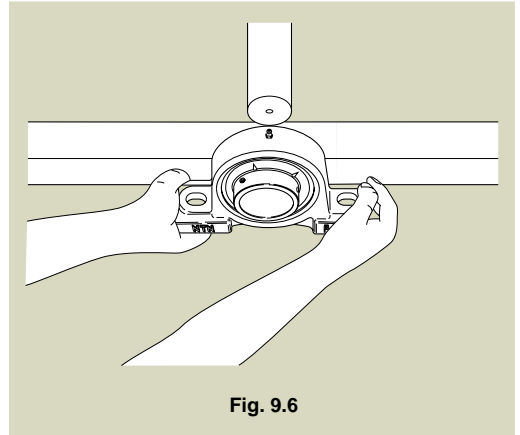


Fig. 9.6

- 3) Insert a hexagonal bar wrench securely into the hexagonal hole of the set screw, and tighten the two screws uniformly. Use the tightening torque shown in Table 9.2.

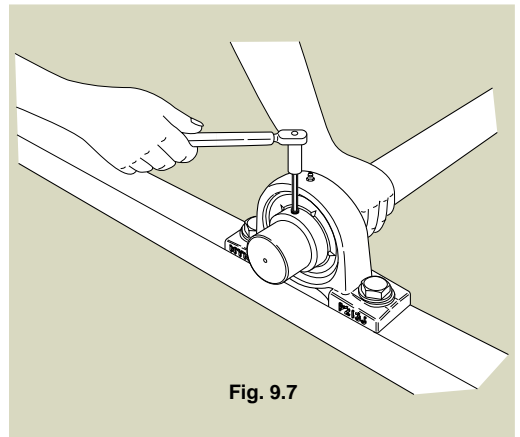


Fig. 9.7

- 4) Mount the housing securely in position on the machine. Sometimes the order of sets 3) and 4) is reversed.

Technical Data

Table 9.2 Recommended torques for tightening set screws

A) Metric series, applied to metric bore size.

Designation of the bearings of applicable units			Designation of set screws	Tightening torques N • m (max.)
UC201 to UC205	—	—	M 5×0.8 × 7	3.9
UC206	—	UC305 to UC306	M 6×0.75 × 8	4.9
UC207	UCX05	—	M 6×0.75 × 8	5.8
UC208 to UC210	—	—	M 8×1 ×10	7.8
UC211	UCX06 to UCX08	UC307	M 8×1 ×10	9.8
UC212	UCX09	—	M10×1.25×12	16.6
UC213 to UC215	—	UC308 to UC309	M10×1.25×12	19.6
UC216	UCX10	—	M10×1.25×12	22.5
—	UCX11 to UCX12	—	M10×1.25×12	24.5
UC217 to UC218	UCX13 to UCX15	UC310 to UC314	M12×1.5×13	29.4
—	UCX16 to UCX17	—	M12×1.5×13	34.3
—	UCX18	UC315 to UC316	M14×1.5×15	34.3
—	UCX20	UC317 to UC319	M16×1.5×18	53.9
—	—	UC320 to UC324	M18×1.5×20	58.8
—	—	UC326 to UC328	M20×1.5×25	78.4

B) Inch series, applied to inch bore size.

Designation of the bearings for the unit to which torques given are applicable			Designation of set screws	Tightening torques lbf • inch (max.)
UC201 to UC205	—	—	No. 10–32UNF	34
UC206	—	UC305 to UC306	1/4–28UNF	43
UC207	UCX05	—	1/4–28UNF	52
UC208 to UC210	—	—	5/16–24UNF	69
UC211	UCX06 to UCX08	UC307	5/16–24UNF	86
UC212	UCX09	—	3/8–24UNF	147
UC213 to UC215	—	UC308 to UC309	3/8–24UNF	173
UC216	UCX10	—	3/8–24UNF	199
—	UCX11 to UCX12	—	3/8–24UNF	216
UC217 to UC218	UCX13 to UCX15	UC310 to UC314	1/2–20UNF	260
—	UCX16 to UCX17	—	1/2–20UNF	303
—	UCX18	UC315 to UC316	9/16–18UNF	303
—	UCX20	UC317 to UC319	5/8–18UNF	477
—	—	UC320	5/8–18UNF	520

Designation of the bearings of applicable units	Designation of set screws	Tightening torques N • m (max.)
AS201 to 205	M5×0.8×7	3.4
AS206	M6×0.75×8	4.4
AS207	M6×0.75×8	4.9
AS208	M8×1×10	6.8

Designation of the bearings for the unit which torques given are applicable	Designation of set screws	Tightening torques lbf • inch (max.)
AS201 to 205	No. 10–32UNF	30
AS206	1/4–28UNF	39
AS207	1/4–28UNF	43
AS208	5/16–24UNF	60

9.2.2 Mounting the eccentric locking collar system unit

In this system, unlike the screw system, the shaft and inner ring are fastened together by fastening the eccentric collar in the direction of the rotation of the shaft. They are fastened together securely, and deformation of the inner ring seldom occurs. This system, however, is not recommended for applications where the direction of rotation is sometimes reversed.

Directions for mounting the unit are as follows:

- 1) Make certain that the frame in which the housing is to be mounted is suitable to the operating conditions with regard to rigidity, flatness, etc.
- 2) Make sure that the end of the shaft is not burred and that the end of the set screw in the eccentric collar is not protruding from the interior surface of the collar (Fig. 9.8).

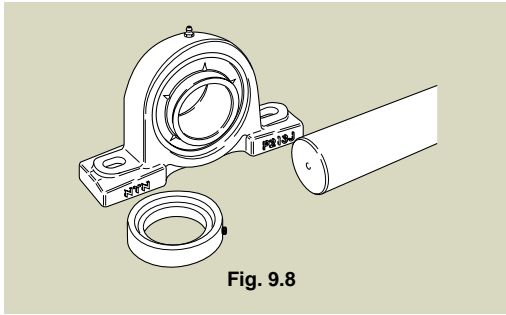


Fig. 9.8

- 3) Mount the housing of the unit securely onto the frame.
- 4) Determine the relative position of the unit and the shaft accurately so that the unit will not be subjected to any thrust, and then insert the eccentric collar (Fig. 9.9).

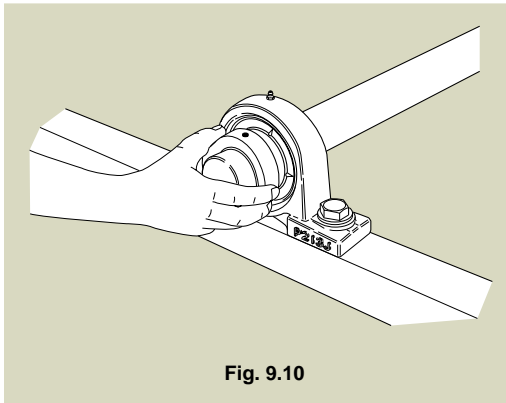


Fig. 9.10

- 5) Fit the eccentric circular ridge provided on the inner ring into the eccentric circular groove of the eccentric collar, and then provisionally tighten by turning the collar by hand in the direction of the shaft (Fig. 9.10).

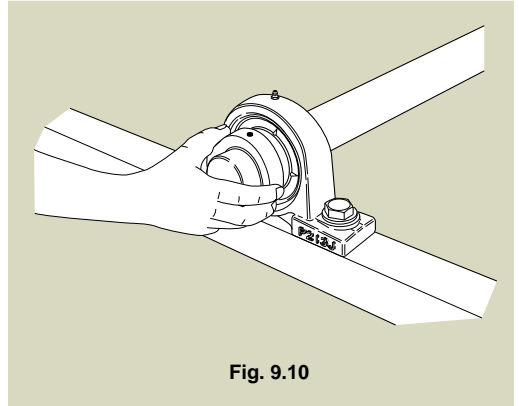


Fig. 9.10

- 6) Insert a bar into the hole provided on the periphery of the eccentric collar and tap the bar so that the collar turns in the direction of rotation of the shaft (see Fig. 9.11).

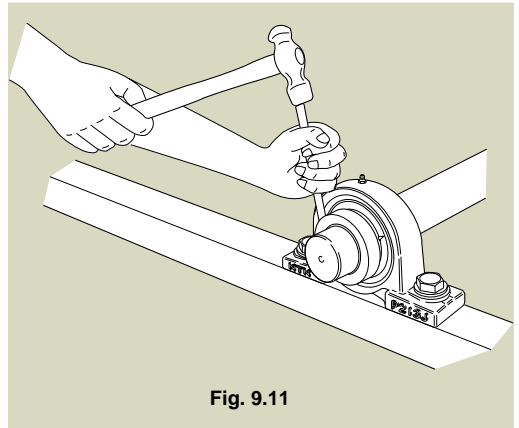


Fig. 9.11

- 7) Fasten the set screw of the eccentric collar onto the shaft. Recommended tightening torques are given in Table 9.3.

Technical Data

Table 9.3 Recommended torques for tightening set screws of the eccentric collar

A) Metric series, applied to metric bore size.

Designation of the bearings of applicable units		Designation of set screws	Tightening torques N • m (max.)	
—	UEL204 to UEL205	AEL201 to AEL205	M6x0.75x8	7.8
UEL303 to UEL307	UEL206	AEL206	M8x1x10	9.8
—	UEL207	AEL207	M10x1.25x12	11.7
—	UEL208 to UEL210	AEL208	M10x1.25x12	15.6
—	UEL211	—	M10x1.25x12	19.6
UEL308 to UEL312	UEL212 to UEL215	—	M10x1.25x12	29.4
UEL313 to UEL314	—	—	M12x1.5x13	34.3
UEL315 to UEL317	—	—	M16x1.5x18	53.9
UEL318 to UEL320	—	—	M20x1.5x25	78.4

B) Inch series, applied to inch bore size.

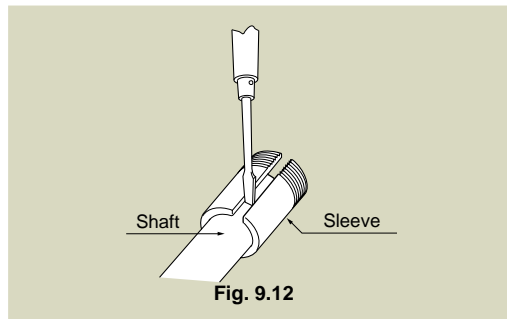
Designation of the bearings for the unit to which torques given are applicable		Designation of set screws	Tightening torques lbf • inch (max.)	
—	UEL204 to UEL205	AEL201 to AEL205	1/4–28UNF	69
UEL303 to UEL307	UEL206	AEL206	5/16–24UNF	86
—	UEL207	AEL207	3/8–24UNF	104
—	UEL208 to UEL210	AEL208	3/8–24UNF	138
—	UEL211	—	3/8–24UNF	173
UEL308 to UEL312	UEL212 to UEL215	—	3/8–24UNF	260
UEL313 to UEL 314	—	—	1/2–20UNF	350
UEL315 to UEL317	—	—	5/8–18UNF	520
UEL318 to UEL320	—	—	3/4–16UNF	700

9.2.3 Mounting of the adapter system unit

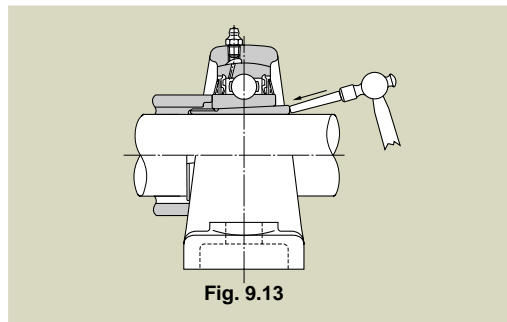
When an adapter system unit is used, there is no danger of the fit between the shaft and the inner ring working loose even if it is subjected to impact loads or vibration. Furthermore, straight shafts of h9 may be used under any operating conditions, except where there is a large axial load.

To mount the adapter system unit onto the shaft, the procedure is as follows:

- Adjust the position of the sleeve so that the tapered part comes to about the center of the bearing. To facilitate the mounting of the sleeve onto the shaft, the opening in the sleeve can be widened using a screwdriver or similar implement. The sleeve should be positioned so that the nut is located on the opposite side form the pulley, etc., for easier handling (Fig. 9.12).



- Place the bearing unit with the tapered bore properly oriented on the sleeve and abut a cylindrical sleeve against the lock nut side face of the inner ring. Tap the adapter sleeve lightly over its entire periphery, as shown in Fig. 9.13, until a positive contact is made between the bearing and the sleeve.



- Insert the washer and tighten the nut fully by hand.
- Apply a jig (or screwdriver where no jig is available) to the notch of the nut and tap it with a hammer. Stop tapping after the nut has turned through from 60° to 90°. Be careful no to strike the slinger. Care should also be taken not to over-tighten the nut, as this will deform the inner ring, causing heat generation and seizure.
- Bend up the tab on the rim of the washer, which is in line with the notch of the nut. This will prevent the nut from turning. The nut must not be turned backwards to bring the notch into line with the tab on the washer.
- Mount the housing securely in position on the machine.

9.2.4 Mounting covered bearing units

For selection of the shaft, mounting the bearing onto the shaft and fitting the housing follow the same procedure as for standard bearing units. Furthermore, fitting the cover presents no special difficulty, with no need for special tools or jigs.

The procedure for mounting covered bearing units is as follows:

- 1) Remove the cover from the bearing unit. The steel cover can also be removed easily by hand, but should there be any difficulty due to an over-tight fit, insert a screwdriver or similar tool in a twisting motion, as shown in Fig. 9.14.

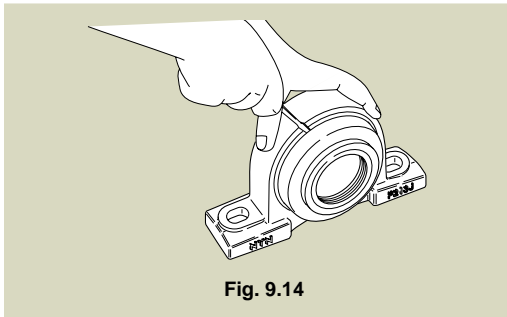


Fig. 9.14

- 2) In order to augment the dust and waterproofing effects, completely fill the space between the two lips of the rubber seal incorporated in the cover with grease, and apply grease to the inside of the cover, filling about two-thirds of the space. Cup grease is commonly used for this purpose (Fig. 9.15.)

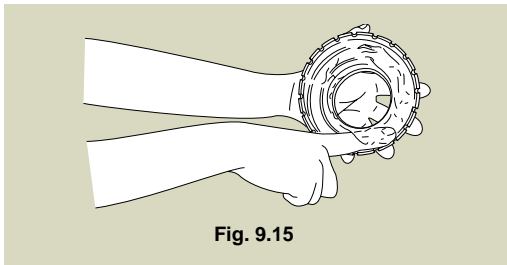


Fig. 9.15

- 3) First, pass one of the two grease-packed covers along the shaft, and then slide the bearing unit onto the shaft and fix the inner ring fast on the shaft before tightening the bolts holding the housing. Sometimes these steps are reversed for convenience of assembly. It is recommended that the end of the shaft be chamfered beforehand to avoid damaging the lips of the rubber seal.

- 4) Next take the cover which has been passed along the shaft and press it into the housing as follows: Be careful not to strike the surface of the steel cover directly with a steel hammer but use a synthetic resin or wood block in between. Do not strike only in one place but tap the cover all the way round until it is firmly seated in the housing. (Fig. 9.16). The cast iron cover is fastened with three bolts.

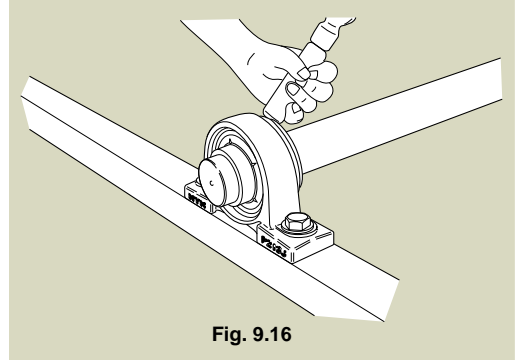


Fig. 9.16

- 5) Pack the second cover with grease as in step 2 and pass it along the shaft. In the case of a blind cover, the recess of the housing should be filled with grease (Fig. 9.15).
- 6) Fit the cover into the recess of the housing using the same procedure as detailed in Step 4) (Fig. 9.17).

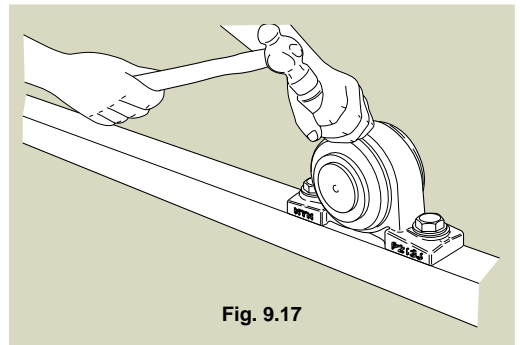


Fig. 9.17

9.3 Running tests

After mounting the bearing unit, check that it has been done correctly.

First, turn the shaft or the rotor by hand to make certain that it rotates smoothly. If there is no irregularity, start up the machine. Run the machine at low speed under no load and gradually bring it up to full operating speed while checking that there are no abnormalities.

Some indications of abnormality or faulty assembly are as follows:

When the shaft is turned by hand a resistance or drag is felt, or the shaft appears to become heavy or light in turn. Or, if the machine is running under power, any abnormal noise, vibration or overheating is evident.

9.4 Inspection during operation

Although the NTN lubrication-free bearing unit does not require refilling with grease while in use, periodic inspections are necessary to ensure safe operation of the unit's most important parts. While the interval between inspections varies from case to case, according to the degree of importance and the rate of operation, it is usually some time between two weeks and a month.

Since the inside of the bearing can be examined only by removing the slinger, seal etc., the condition of the bearing should be judged by checking for the presence of vibration, noise, overheating of the housing, etc., while the machine is running.

9.5 Dismounting the bearing unit

If some abnormality makes it necessary to dismount the bearing unit from the shaft in order to replace it, the procedure used to mount the bearing is followed in reverse order. In this case, special care should be given to the following points:

- 1) Set screw system units:
If the set screw is protruding into the bore of the bearing when the unit is withdrawn from the shaft, it will damage the shaft. Therefore the screw should be turned back fully.
- 2) Adapter system units:
To remove an adapter system bearing unit from the shaft, raise the tab of the washer, turn the nut two or three turns back, and apply a metal block to the nut and tap it with a hammer. Do this all round the nut, until the sleeve can be moved (Fig. 9.18).
If the nut is turned back too far and the screws are only slightly engaged, tapping to remove it will eventually ruin the screws.

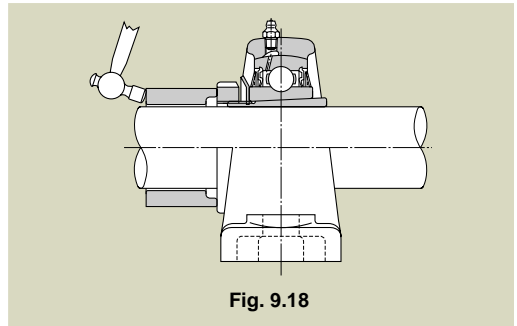


Fig. 9.18

9.6 Replacement of the bearing

If the bearing in the NTN bearing unit needs to be replaced, this can be carried out simply with a plummer block. There is no need to replace the housing, as it is reusable.

The bearing is changed using the following procedure: First, the set screw should be tightened as much as possible. Otherwise, there is a danger that it may catch in the housing when the bearing is tilted.

Next, insert the handle of a hammer or similar tool into the bore of the bearing and twist. Tilt the bearing through a full 90°, and pull it in the direction of the notch on the housing to remove it. To install a new bearing in the housing, follow the same procedure in reverse.