

# DODGE HFO Plummer Blocks Instruction and Lubrication Manual

These instructions must be read thoroughly before installing or operating this product.

**WARNING** To ensure the drive is not unexpectedly started, turn off and lock-out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.

## Mounting Instructions for HFO Plummer Blocks

### Mounting of the Plummer Blocks

Proper shaft support usually requires the use of one non-expansion and one expansion bearing. The floating bearing permits expansion of the shaft due to thermal growth. DODGE HFO plummer blocks are designed and fabricated to be used as either expansion or non-expansion bearings. Spacer rings are included in each housing. The rings are used for non-expansion bearings; they are not used for expansion bearings.

### Inspection

Inspect the shaft. Make sure it is smooth, straight, clean and conforms to the correct dimensional tolerances. Inspect all parts prior to assembly.

## Adapter Mounted Bearings

### Fixed Bearing (Non-Expansion)

1. Install the non-expansion bearing first. Apply a light coating of machine oil to the shaft in the area where the adapter will come in contact with the shaft.
2. Measure the internal clearance of the bearing before mounting. Place the bearing in an upright position as shown in Figure 1. Seat the inner ring and roller elements by pressing firmly on the inner ring bore while rotating the inner ring a few times. Position the roller assemblies so that a roller is at the topmost position on each row (12:00 o'clock). For bearings 165mm and greater, press these top rollers inward, ensuring contact with the center guide. Using a feeler gauge, measure the clearance over both sides by inserting the gauge as far as possible and sliding it over the top of the roller (See Figure 1). Record the measured clearance value for use in Step 3e.

**WARNING:** Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed. Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric Company nor are the responsibility of Baldor Electric Company. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a holding device must be an integral part of the driven equipment beyond the speed reducer output shaft.

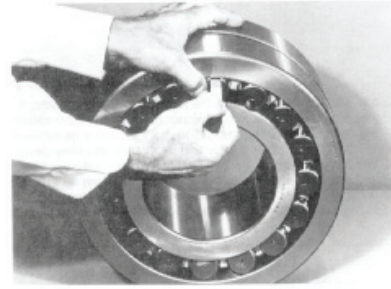


Figure 1 -- Measure the Initial Clearance

The value should be within the range shown in Table 1, column "Radial Clearance Prior To Mounting".

**Note:** Do not rotate bearing rings when moving feeler between roller and outer ring.

3. Install the plummer block and the bearing parts in the following sequence, using Figure 2 as a guide:
  - a. Prior to placing the inboard end cover on the shaft, determine if the bearing and the seals are to be oil lubricated. If so, remove the plastic plug from the oil return drain hole located at 6 o'clock in the annular ring groove of the end cover. If the seal is to be grease lubricated, do not remove the oil drain plug, but instead remove the plastic cap from the 12 o'clock position of the outer surface of the end cover and install a grease fitting. Slide the inboard end cover (3) onto the shaft. Then, slide one of the end cover gaskets over the shaft and place next to the end cover. (Use of sealant on the gaskets, as well as between the housing cap and base, is recommended).
  - b. Slide the inboard side labyrinth seal ring (6) onto the shaft. The serrations on the OD of the seal must point away from the bearing.
  - c. Slide one of the spacer rings (12) onto the shaft.
  - d. Slide the adapter onto the shaft with the threaded end facing away from the inboard end cover. Locate the adapter at the proper location on the shaft and apply a light coat of oil to the OD of the adapter sleeve. Do not use grease. Install bearing (5) on adapter sleeve. Slide the oil ring (8) on the sleeve and position in the appropriate groove.
  - e. Slide the lock washer on the sleeve, and then thread the locknut onto the threaded adapter sleeve. Tighten locknut by hand until firmly hand-tight. From the value recorded in Step 2, subtract the min and max values from the column "Reduction in Radial Clearance" in Table 1. The result is the final clearance range. Using a spanner wrench (or hammer and drift) tighten the locknut until the bearing clearance falls within this range. In no case should the clearance be less than that shown in the column "Smallest Permissible Radial Clearance After Mounting" in Table 1. Double-row



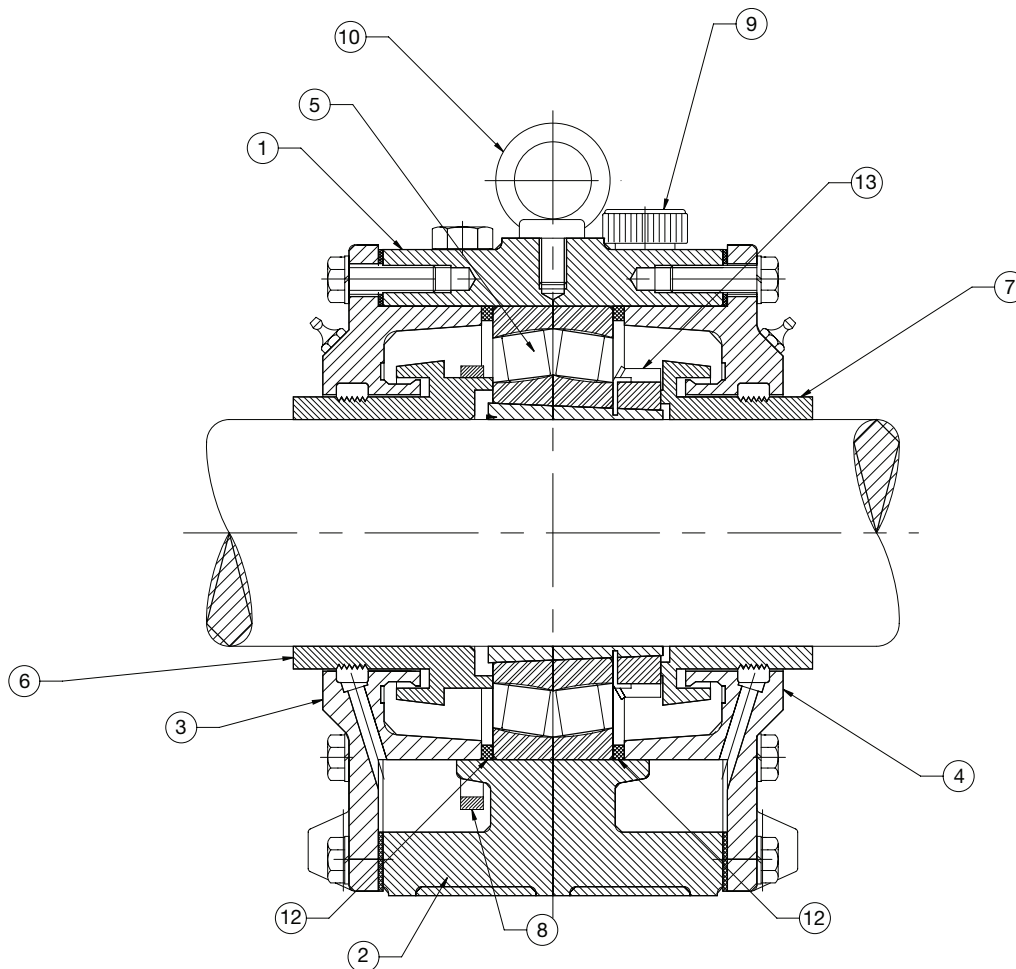
spherical roller bearings are properly mounted when the correct reduction in clearance (radial play) is achieved. Remember that the bearing position will shift axially inboard approximately 17 times the reduction of radial clearance shown in Table 2. Bend one tang of the lock washer into one of the openings in the OD of the nut. If necessary, tighten (never loosen) the locknut to allow the tang to fit the nut. Tightening of the bearing on the shaft could also be achieved by using a hydraulic nut.

- f. After properly securing the bearing to the shaft, slide the right side labyrinth seal ring (7) onto the shaft against the adapter sleeve. For HFO seals with drilled and tapped holes, dimple the shaft to a depth of 4mm and, using proper setscrews, tighten the screws to lock the labyrinth rings. While tightening the setscrews, push on the labyrinth ring in the direction of the bearing so that contact is made between the labyrinth face and the bearing.
- g. Slide the remaining spacer ring onto the shaft.
- h. Slide the bottom half of the housing (2) under the bearing; position the spacer rings against the bearing outer ring and align all with the bearing housing. Align and hand tighten the mounting bolts to the frame. Place the top

half of the housing (1) over the bearing, and secure the top half to the bottom, using the four cap bolts.

- i. Slide the second gasket on the shaft. Prior to sliding the outer end cover (4) over the shaft, repeat the process regarding the plastic plug and cap described in step 3), a) above. Slide the end cover on the shaft. Bolt both the inboard and outboard covers to the housing, tightening the bolts to the prescribed torque specifications shown in Table 2.
- j. Check again the mounting location of the HFO housing to ensure it is correct. If not, adjust the position. Do not fully torque the housing to the frame at this time. Full torque will be applied after the expansion bearing is mounted.

Check misalignment of the plummer block by inserting a feeler gauge between the labyrinth sleeve OD and the bore of the end cover. Insert the feeler gauge at 12:00 o'clock, 6:00 o'clock, 3:00 o'clock and 9:00 o'clock. The reading at each position must be at or between 0.1mm and 0.2mm. If the readings do not conform to these values, loosen the base bolts and realign the housing. Shimming may be necessary.



- |                                       |   |
|---------------------------------------|---|
| 1. Housing cap                        | 7. Seal/flinger (oil inlet side)        |
| 2. Housing base                       | 8. Oil ring                             |
| 3. Bolt-on end cover (oil ring side)  | 9. Oil filler plug                      |
| 4. Bolt-on end cover (oil inlet side) | 10. Eye bolt (for lifting housing only) |
| 5. Spherical roller bearing           | 11. Oil sight glass (not shown)         |
| 6. Seal/flinger (oil ring side)       | 12. Spacer rings                        |

**Figure 2 - HFO Adapter Mount Bearing**

## Expansion Bearing

The procedure used to mount non-expansion bearings is also used to mount expansion bearings, with the following exception: do not use or install the spacer rings: discard them. Spacer rings are to be used in the non-expansion bearing only. During Step 3i, check that the housing aligns with the mounting holes of the frame and that the bearing sits in the center of the housing.

After completing Steps a-k above for the expansion bearing, tighten all the mounting bolts using the torque values specified in Table 3.

Check misalignment of the plummer block by inserting a feeler gauge between the labyrinth sleeve OD and the bore of the end cover. Insert the feeler gauge at 12:00 o'clock, 6:00 o'clock, 3:00 o'clock and 9:00 o'clock. The reading at each position must be at or between 0.1mm and 0.2mm. If the readings do not conform to these values, loosen the base bolts and realign the housing. Shimming may be necessary.

## Direct Mounted Bearings

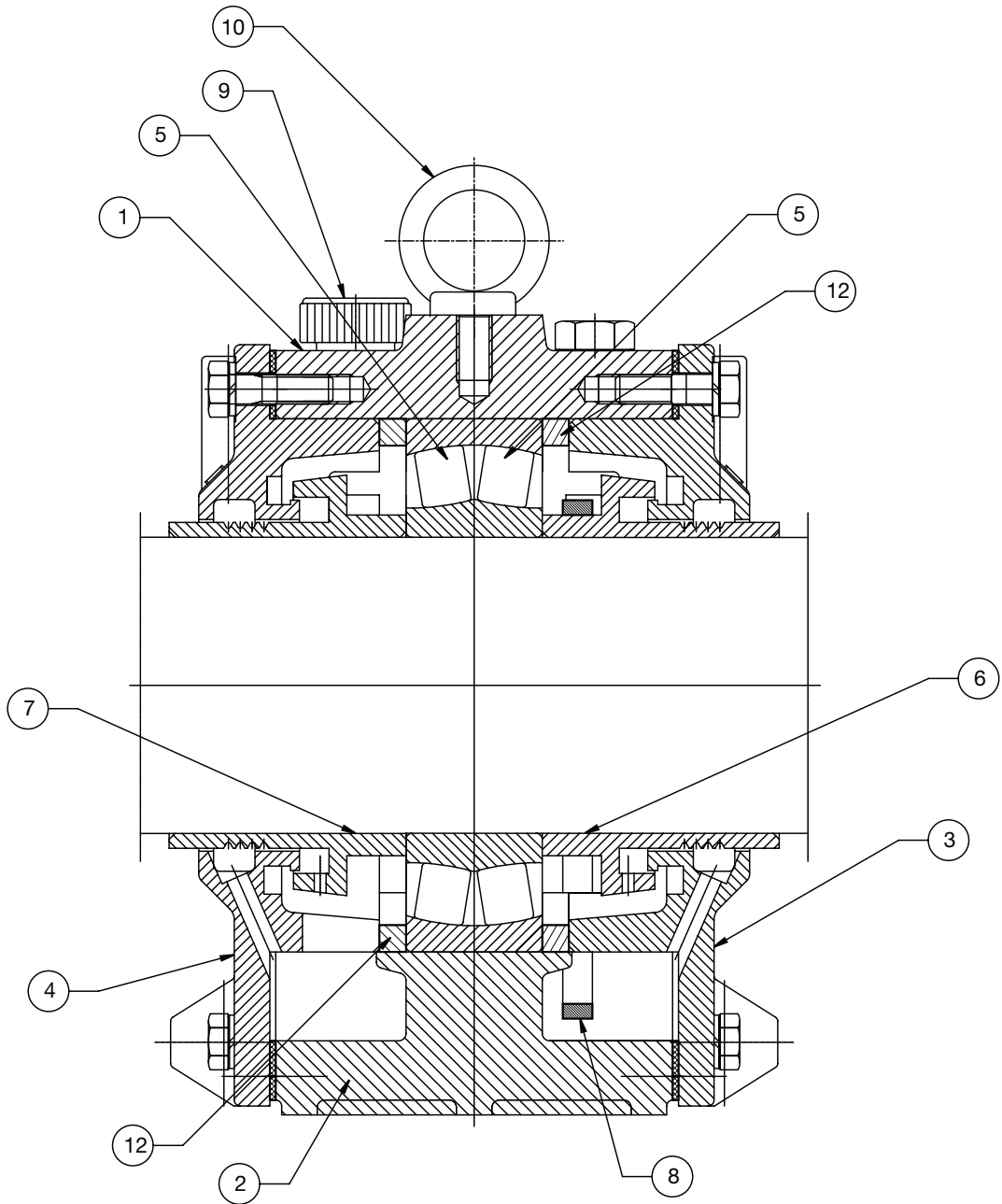
For direct mounted bearings it is not necessary to measure the internal clearance of the bearing. It is, however, necessary to check the markings on the bearing faces to ensure the correct bearing is being installed. It is also important to verify the shaft diameters are within tolerances. Mount components in the following order:

1. Prior to placing the inboard end cover on the shaft, determine if the bearing and the seals are to be oil lubricated. If so, remove the plastic plug from the oil return drain hole located at 6 o'clock in the annular ring groove of the end cover. If the seal is to be grease lubricated, do not remove the oil drain plug, but instead remove the plastic cap from the 12 o'clock position on the outer surface of the end cover and install a grease fitting. Slide the inboard end cover (4) onto the shaft.
2. Slide one of the gaskets on the shaft and place it adjacent to the inboard cover.
3. Slide labyrinth seal (7) (normally larger bore) onto the shaft. The serrations on the OD of the seals must point away from the bearing rolling elements.
4. For non-expansion bearings, slide one spacer ring onto the shaft.

5. Heat the bearing to 100°C, then slide onto the shaft. Use the face of the labyrinth seal (or the spacer ring) to hold the bearing until it has cooled sufficiently to not move on the shaft.
6. Insert the smaller bore labyrinth seal ring (6) onto the shaft and slide against the face of the bearing.
7. Slide the base of the housing (2) under the bearing, align and hand tighten the mounting bolts to the frame. For non-expansion bearings slide the remaining spacer ring onto the shaft. Position both spacer rings against the bearing outer ring and align in the housing base. Place the housing cap (1) over the bearing, and bolt the cap securely to the base.
8. Slide the second gasket over the shaft and against the housing.
9. Prior to sliding the outboard end cover (3) on the shaft, repeat the process regarding the plastic plug and cap described in step 1) above. Slide the outboard end cover on the shaft.
10. Tighten the bolts on both the inboard and outboard covers to the prescribed torque specifications shown on Table 2.
11. After both non-expansion and expansion bearings have been installed, tighten all the base mounting bolts to the torque values shown in Table 3.
12. Check misalignment on each plummer block housing by inserting a feeler gauge between the labyrinth sleeve OD and the bore of the end cover. Insert the feeler gauge at 12:00 o'clock, 6:00 o'clock, 3:00 o'clock and 9:00 o'clock. The readings at the two positions must be at or within 0.1mm and 0.2mm. If the readings do not conform to these values, loosen the base bolts and realign the housing. Shimming may be necessary.

Due to the axial expansion capability of the floating bearing, it is possible to compensate for minor mounting inaccuracies or measurements as well as thermal shaft growth. The expansion capabilities of HFO bearings are shown in the Dodge Mounted Bearing Catalog ([www.baldor.com](http://www.baldor.com)).

Maximum expansion may be obtained if the plummer block is shifted completely to one side relative to the bearing. Normally the bearing is mounted centered in the plummer block permitting half the expansion or contraction amount in either direction.



- |                                       |   |
|---------------------------------------|---|
| 1. Housing cap                        | 7. Seal/flinger (oil inlet side)        |
| 2. Housing base                       | 8. Oil ring                             |
| 3. Bolt-on end cover (oil ring side)  | 9. Oil filler plug                      |
| 4. Bolt-on end cover (oil inlet side) | 10. Eye bolt (for lifting housing only) |
| 5. Spherical roller bearing           | 11. Oil sight glass (not shown)         |
| 6. Seal/flinger (oil ring side)       | 12. Spacer rings                        |

**Figure 3 - HFO Direct Mount Bearing**

## Materials

HFO Plummer Blocks are available in either gray cast iron, GG25, or spheroidal ductile iron, GGG40.

## Seals

HFO bearings utilize non-contacting labyrinth seals. The labyrinth seals work well under normal functional requirements and normal loads. For harsher conditions particularly affected by dust and dampness, the effectiveness of the sealing system can be improved by injecting NLGI 3 or 4 consistency grease directly into the seal area. HFO bearings are equipped with a plastic plug inserted into the drain hole of the annular ring groove of the cover. This plug is removed under normal conditions. When additional grease dam protection is desired the plastic plug must be left in the annular groove return drain hole. The plug prevents grease from being pumped into the oil sump.

## Lubrication

Lubrication of the spherical roller bearings in HFO plummer blocks is done by conveying oil from the oil sump via an oil ring. The turning of the shaft causes the oil ring to rotate, picking up oil and conveying it to the top of the bearings, where it drains down over and through the rolling elements and back into the sump. When appropriate oil levels are maintained, the sump dimensions ensure proper lubrication of the bearing. While in the sump, the oil cools to the ambient temperature of the housing base before it re-circulates. This system of lubrication permits higher RPMs. The oil ring is used to maintain a large differential between minimum and maximum oil sump level. Therefore the time between oil refills is extended. Oil level at start-up should be set at maximum.

The oil level indicator provided may be mounted in any of the four drilled and tapped holes found on the covers. The other holes may be used for drains when changing oil. The oil level “min” and “max” shown in Table 3 must be marked on the sight gauge.

## Oil Selection

Due to the high operating speeds of the HFO it is recommended that either mineral or synthetic oil be used. Oils should incorporate additives to protect against aging, corrosion and foaming. The most important parameter of the oil is its viscosity which affects service temperature. The viscosity of the oil should be selected based on the guidelines shown in Table 1. If the temperature of the bearings reach 80°F to 100°F or greater above ambient, a lighter viscosity oil may be required.

ΔDN	Viscosity for Loads Up to 18% of Dyn. Cap (SUS @ Oper. Temp.)	CST
100	3500	700
200	3150	680
300	2750	590
400	2375	500
500	2000	460
600	1750	360
700	1500	320
800	1300	280
900	1075	220
1000	900	140
1400	625	140
1600	525	120
1800	450	95
2000	400	85
3000	300	63
4000	200	43
5000	150	32
6000	130	28
7000	110	22
8000	100	20

ΔDN = Bore Diameter (ins.) x RPM

## Limiting Speeds

Oil-lubricated DODGE HFO plummer blocks are particularly suited for service conditions with high speeds. Recommended speed limits are shown in our catalog and may be reached under the following conditions:

Loads are primarily radial; axial load is less than 20 % of radial load. The equivalent load at operating speed will yield an L10 life greater than 50,000 hours. Appropriate oil cooling is achieved by normal circulation of ambient air around the plummer block. Self-aligning bearings are C3 clearance. The maximum concentricity of direct mount bearings helps achieve maximum speeds.

## Bearing Radial Play

If RPMs exceed 70% of the limiting speed of the bearing as found in the manufacturers' catalogues, bearings with higher internal clearances must be selected because of higher running temperatures. At the same time, if there is heat being introduced into the blocks via the shaft so that the temperature difference between inner ring and outer ring is greater than normal, then bearings with internal clearance greater than C3 must be selected.

Bearings with tapered bore can be safely removed from the shaft with the help of hydraulic sleeves.

For HFO plummer blocks with cylindrical bore, it is advisable to mount the oil ring on the side adjacent to the end of the shaft. The oil sight gauge vent must be kept free and unplugged. A bubble of air in the tube can cause an incorrect reading. For plummer blocks adjacent to electromagnetic devices a brass oil ring should be used.

## Maintenance

Before start up, the plummer block must be filled with the proper amount of oil. Minimum and maximum oil levels are shown in Table 4. The maximum oil level ensures the lower portion of the bearing is lubricated at start-up when the oil ring is not yet carrying oil to the top of the bearing.

Before each start-up and after each long-duration shutdown, the

oil level in the sump should be brought to the maximum level. Even after having carefully cleaned the plummer block prior to mounting it is possible that some dirt will remain in the plummer block cavity. Therefore it is recommended that after two or three hours of initial running, a full oil change be carried out. Oil change frequency should be based on the oil type used and on the running conditions, especially running temperature. Oil should be changed at least once a year. Oil changes should be done only when the system is shutdown. If, during trial runs, no leaks are detected, it is sufficient to inspect oil level once a month. During operation the oil level may be as low as the minimum level shown in Table 4. It is permissible to add oil during operations until the oil reaches a level 5 mm below the maximum level shown in Table 4.

DODGE HFO plummer blocks come standard with two M10 holes and one M24 hole to allow for use of vibration and temperature sensors.

## How to order

Complete housing units, including seals, may be ordered. Bearings, locknuts and lock washers must be ordered separately. Housing and seals may be ordered separately if desired.

## Allowable Loads

Please refer to the DODGE Mounted Bearing Catalogue for load data.

**Table 2 - Radial Clearance Reduction for Spherical Roller Bearings used in HFO Plummer Blocks**

Basic Bearing Description		Reduction in Radial Clearance (mm)		Radial Clearance Prior to Mounting (mm)		Axial Displacement of Bearing Relative to Sleeve (mm)		Smallest Permissible Radial Clearance After Mounting (mm)
		MIN	MAX	MIN	MAX	MIN	MAX	
	22310K	0.0254	0.0305	0.0610	0.0787	0.4572	0.5080	0.0356
	22311K	0.0305	0.0381	0.0762	0.0940	0.4572	0.5080	0.0381
	22312K	0.0305	0.0406	0.0762	0.0940	0.5080	0.7112	0.0356
	22314K	0.0305	0.0406	0.0762	0.0940	0.5080	0.7112	0.0356
	22316K	0.0406	0.0508	0.0940	0.1194	0.7112	0.8382	0.0432
22217K		0.0457	0.0635	0.1092	0.1397	0.7620	0.9906	0.0610
22218K	22318K	0.0457	0.0635	0.1092	0.1397	0.7620	0.9906	0.0610
22219K		0.0457	0.0635	0.1092	0.1397	0.7620	0.9906	0.0610
22220K	22320K	0.0457	0.0635	0.1092	0.1397	0.7620	0.9906	0.0610
22222K	22322K	0.0508	0.0711	0.1346	0.1702	0.7874	1.1938	0.0813
22224K	22324K	0.0508	0.0711	0.1346	0.1702	0.7874	1.1938	0.0813
22226K	22326K	0.0635	0.0889	0.1600	0.2007	1.1938	1.4986	0.0914
22228K	22328K	0.0635	0.0889	0.1600	0.2007	1.1938	1.4986	0.0914
22230K	22330K	0.0762	0.1016	0.1803	0.2311	1.2954	1.7018	0.1016
22232K	22332K	0.0762	0.1016	0.1803	0.2311	1.2954	1.7018	0.1016
22234K	22234K	0.0762	0.1143	0.2007	0.2591	1.3970	1.9050	1.1143
22236K	22236K	0.0762	0.1143	0.2007	0.2591	1.3970	1.9050	0.1143
22238K		0.0889	0.1295	0.2210	0.2896	1.4986	2.2098	0.1270
22240K		0.0889	0.1295	0.2210	0.2896	1.4986	2.2098	0.1270
22244K		0.1016	0.1397	0.2489	0.3200	1.7018	2.3876	0.1448

**Table 3 - HFO TORQUE VALUES**

HOUSING				CAP BOLTS			
				Qty	Size	Torque (lb.-ft.)	Grade
HFO 217	HFO 517			4	M12 X 75	50	8.8
HFO 218	HFO 518			4	M12 X 75	50	8.8
HFO 219	HFO 519			4	M12 X 70	50	8.8
HFO 220	HFO 520			4	M12 X 70	50	8.8
HFO 226	HFO 526			4	M16 X 100	120	8.8
HFO 228	HFO 528			4	M20 X 110	235	8.8
HFO 230	HFO 530			4	M20 X 110	235	8.8
HFO 232	HFO 532			4	M20 X 130	235	8.8
HFO 234	HFO 534			4	M24 X 140	405	8.8
HFO 236	HFO 536			4	M24 X 150	405	8.8
HFO 238	HFO 538			4	M24 X 160	405	8.8
HFO 240	HFO 540			4	M24 X 160	405	8.8
HFO 244	HFO 544			4	M30 X 180	810	8.8
HFO 248	HFO 548			4	M30 X 180	810	8.8
		HFO 310	HFO 610	4	M12 X 70	50	8.8
		HFO 311	HFO 611	4	M12 X 70	50	8.8
		HFO 312	HFO 612	4	M12 X 80	50	8.8
		HFO 314	HFO 614	4	M12 X 80	50	8.8
		HFO 316	HFO 616	4	M16 X 90	120	8.8
		HFO 318	HFO 618	4	M16 X 90	120	8.8
		HFO 320	HFO 620	4	M16 X 100	120	8.8
		HFO 322	HFO 622	4	M16 X 100	120	8.8
		HFO 324	HFO 624	4	M20 X 120	235	8.8
		HFO 326	HFO 626	4	M20 X 110	235	8.8
		HFO 328	HFO 628	4	M20 X 110	235	8.8
		HFO 330	HFO 630	4	M24 X 150	405	8.8
		HFO 332	HFO 632	4	M24 X 160	405	8.8
		HFO 334	HFO 634	4	M24 X 160	405	8.8
		HFO 336	HFO 636	4	M30 X 180	810	8.8

Table 4 - HFO Oil Lubrication Data					
Housing		Oil level		Oil Quantity	Max. RPM - oil lubrication
		max. mm	min. mm		
HFO 217	HFO 517	63	42	0.7	3800
HFO 218	HFO 518	68	45	0.8	3400
HFO 219	HFO 519	70	50	0.9	3200
HFO 220	HFO 520	70	50	1.0	3000
HFO 222	HFO 522	77	50	1.5	2800
HFO 224	HFO 524	80	60	1.9	2400
HFO 226	HFO 526	85	60	2.5	2200
HFO 228	HFO 528	85	60	2.7	2000
HFO 230	HFO 530	90	60	3.0	1900
HFO 232	HFO 532	95	65	3.3	1800
HFO 234	HFO 534	105	75	5.0	1700
HFO 236	HFO 536	115	80	5.2	1600
HFO 238	HFO 538	120	85	5.8	1300
HFO 240	HFO 540	125	85	7.4	1200
HFO 244	HFO 544	140	95	9.0	1000
HFO 248	HFO 548	155	110	10.0	900
HFO 310	HFO 610	53	33	0.4	4300
HFO 311	HFO 611	53	37	0.5	4000
HFO 312	HFO 612	60	40	0.6	3600
HFO 314	HFO 614	65	45	0.8	3200
HFO 316	HFO 616	73	45	1.3	3000
HFO 318	HFO 618	80	55	1.5	2600
HFO 320	HFO 620	85	57	1.9	2200
HFO 322	HFO 622	95	67	2	1900
HFO 324	HFO 624	100	65	3.2	1800
HFO 326	HFO 626	105	70	3.6	1700
HFO 328	HFO 628	115	70	4.5	1600
HFO 330	HFO 630	120	75	6	1500
HFO 332	HFO 632	125	80	6.5	1400
HFO 334	HFO 634	130	85	7.5	1300
HFO 336	HFO 636	155	90	10.5	1100

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