

No. 9D Flexidyne® Drive Instruction Manual

These instructions must be read thoroughly before installation or operation. This instruction manual was accurate at the time of printing. Please see dodgeindustrial.com for updated instruction manuals.

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.

WARNING: All products over 25 kg (55 lbs) are noted on the shipping package. Proper lifting practices are required for these products.

INSTALLATION

Flexidyne dry fluid couplings are a unique concept to provide soft start and momentary overload protection for all types of driven equipment. Standard NEMA-B motors with RPM base speeds of 1750, 1160 or 860 are commonly used with a Flexidyne, yet other available power sources may be used with the Flexidyne.

The dry "fluid" in the Flexidyne is heat treated steel shot. A measured amount, referred to as flow charge, is added into a housing which has been keyed to the motor shaft. When the motor is started, centrifugal force throws the flow charge to the perimeter of the housing, packing it between the housing and the rotor which in turn transmits power to the load.

After the starting period of slippage between housing and rotor the two become locked together and achieve full load speed, operating without slip and with 100% efficiency.

Consequently, the motor accelerates instantly to base speed, while the load starts gradually and smoothly.

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 Dodge® nor are the responsibility of Dodge. 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.

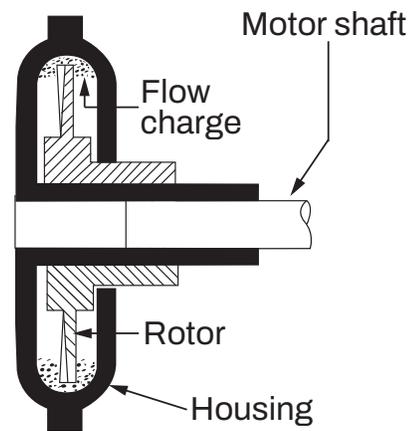


Figure 1 - Housing Cross Section

Install sheave on driven hub using key furnished. Do not use sheaves with set screws that exert pressure on the key or driven hub; they may distort the driven hub and damage the roller bearing. Taper-Lock® sheaves may be installed per the instruction sheet supplied with bushing.

If using a Flexidyne special bolt-on sheave, install the sheave on the driven hub. Use screws and lockwashers provided with the sheave. Torque screws to 160 inch-pounds.

Slide the Flexidyne Drive on the motor shaft with collar as close to motor as possible. Tighten key set screw securely against motor shaft key. Tighten shaft set screw against motor shaft.

Note that drive hub must be installed on the motor shaft (or on other installations it must be the first part of the Flexidyne to receive power from the power source) to permit proper operation of the Flexidyne Drive.

START-UP

1. The flow charge recommended in Table 1 is the amount required per cavity required. To assure a more even initial distribution of flow charge, remove filler plugs and pour one half of the recommended amount in both cavities. Replace filler plugs being careful to clear threads of any flow charge. Manually rotate the Flexidyne housing several turns. Remove filler plugs and pour in remaining amount of flow charge. Clear threads as before, replace filler plugs and torque to 200 in. lbs.

2. Attach AC ammeter (conventional clamp-on or equivalent) to one line of the AC motor. Set range to cover 200% of motor nameplate current.
3. Note the maximum allowable acceleration time for Flexidyne as stated in Tables 1 and 2.

Note that Table 2 lists starting time capacity for starting cycles occurring more than once every 2 hours.

4. Push start button. Observe motor current during load acceleration and number of seconds required to reach full speed (Figure 2).

INCREASE AMOUNT OF FLOW CHARGE IF

- A. Acceleration time reaches maximum allowable before load is up to speed. Turn off power immediately if this time is reached.
- B. Acceleration amperage is below motor nameplate.

DECREASE AMOUNT OF FLOW CHARGE IF

- A. Acceleration time is less than 1½ seconds.
- B. Acceleration amperage is above 200% of motor nameplate.

CAUTION: The rotor of the Flexidyne must slip during acceleration to allow flow charge to become evenly distributed in the Flexidyne housing. Therefore, do not allow Flexidyne to run "free" (that is, without a load on the driven end), otherwise a dangerous out-of-balance condition may result.

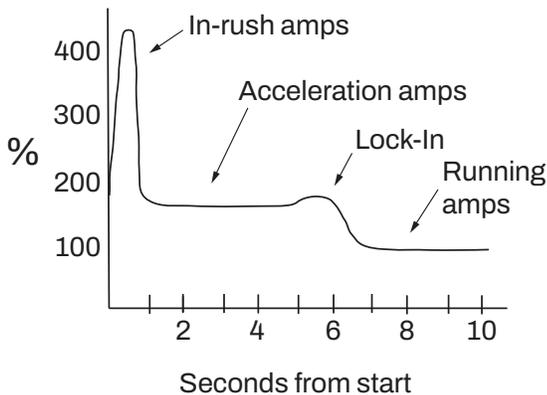


Figure 2 - Flow Charge Ratios

OPERATION

The amount of flow charge in the Flexidyne determines the acceleration time for a given load. Longer acceleration times will occur when less flow charge is used and faster acceleration, from stop to full speed, will be observed with greater amounts of flow charge.

The Flexidyne should start the load smoothly and without delay provided the proper amount of flow charge has been used. Should the acceleration time exceed the maximum allowable in Table 1, shut off power to the Flexidyne immediately. Allow the Flexidyne to cool, then add small amounts of flow charge until proper acceleration is observed.

Vibration is an indication of accelerating too rapidly and not allowing flow charge to become evenly distributed in the Flexidyne housing. This can be corrected by removing small amounts of flow charge until vibration subsides. Other causes of vibration are, undersize shafting, unit not installed far enough on shaft or worn bore in the unit.

Slippage – The Flexidyne can, without slipping, transmit overloads up to 130% of its present starting torque. Should this breakaway torque be exceeded the Flexidyne will slip and generate heat (see Overload Protection). Although slippage usually indicates increased loads, it can also be caused by worn flow charge or a worn rotor especially if the Flexidyne has been in operation for some time. The necessity to replace either a rotor or flow charge will be made evident by a loss in power transmitting capacity of the Flexidyne.

MAINTENANCE

For average industrial applications involving 3 or 4 starts a day of not more than 6 seconds acceleration time each, the flow charge should be changed every 10,000 hours of operation. For more severe conditions, visually inspect flow charge at more frequent intervals; it should be changed when it has deteriorated to a half powder, half granular condition. Visual inspections should continue until enough flow charge changes have been made to adequately establish a schedule for renewing Flexidyne flow charge.

The Flexidyne has been lubricated at the factory and no further lubrication is required. Never apply grease, oil or any other foreign material to the flow charge.

THERMAL CAPACITY

Since there is slippage within the flow charge during acceleration, heat is generated from friction. The thermal capacity of the Flexidyne is based on balancing this heat generated during acceleration against the cooling time between accelerations. The amount of heat generated is determined by the amount of horsepower dissipated by slipping and the duration of each acceleration. If the flow charge weight is light, the heat generated will not be as great as that which would be generated with a heavier flow charge, when compared at the same acceleration time. A longer time between starts will dissipate more heat; therefore, higher starting horsepowers may be transmitted, or longer acceleration times may be allowable. (See starting cycle below)

Acceleration times shown in Table 1 are for starting frequencies of one start per hour or less. If starting frequency is more than once per hour, use acceleration time for actual starting cycle shown in Table 2.

Acceleration times listed in Tables 1 and 2 are the MAXIMUM permissible for the various starting frequencies listed. The MINIMUM acceleration time required for proper Flexidyne operation is 1 to 1½ seconds. This is the time required for the flow charge to be uniformly distributed around the housing cavity before the unit “locks in”. Any acceleration time between the minimum and maximum listed is acceptable, although a shorter acceleration time will generally provide longer wear life. For application requiring a specific acceleration time (within these limits) flow charge may be added or removed to produce the required results.

Stalled – If a jam-up stalls the drive, the motor continues to run and the Flexidyne slips. This causes heat to be generated at twice the rate of normal acceleration. Therefore, the allowable slipping time, when stalled, is half the allowable acceleration time given in Table 1.

Starting Cycle is the time from the beginning of one acceleration to the beginning of the next. Allowable acceleration times in Table 2 are based on the assumption that the Flexidyne will be running continuously except for a momentary stop before the next start. If the stop is more than momentary, decrease the actual starting cycle by one-half the stopped time before using Table 2; for example, with a 50 minute actual starting cycle of which 20 minutes is stopped time, decrease 50 by half of 20 to give 40 minutes as the starting cycle time to use for Table 2.

Grouped Starts – For several starts grouped together followed by uninterrupted running, add the acceleration times of all starts and consider it as the time for one start. The starting cycle would be the time from the beginning of one group of starts to the beginning of the next group.

Table 1: Flow Charge Recommendations for No. 9D Flexidyne Drive

1760 RPM NEMA Design B Motors					
Rated Motor HP	% Starting Torque	Starting HP	Flow Charge		Max. Time in Sec
			Lbs.	Oz.	
15	100% @ 1760 RPM	15.0	2	9	76
	125% @ 1750 RPM	18.8	3	0	58
	150% @ 1740 RPM	22.3	3	7	58
	175% @ 1700 RPM	25.5	3	13	39
	200% @ 1650 RPM	28.3	4	2	28
20	100% @ 1760 RPM	20	3	2	52
	125% @ 1750 RPM	25	3	10	40
	150% @ 1740 RPM	30	4	0	26
	175% @ 1700 RPM	34	4	8	22
	200% @ 1650 RPM	38	5	3	16

1776 RPM NEMA Design B Motors					
Rated Motor HP	% Starting Torque	Starting HP	Flow Charge		Max. Time in Sec
			Lbs.	Oz.	
5	100% @ 1175 RPM	5.0	2	4	230
	125% @ 1160 RPM	6.2	2	11	212
	150% @ 1150 RPM	7.4	3	1	193
	175% @ 1130 RPM	8.5	3	8	176
	200% @ 1100 RPM	9.4	3	12	161
7-1/2	100% @ 1175 RPM	7.5	3	0	191
	125% @ 1160 RPM	9.3	3	9	163
	150% @ 1150 RPM	11.1	3	14	144
	175% @ 1130 RPM	12.7	4	4	134
	200% @ 1100 RPM	14.1	4	12	126

875 RPM NEMA Design B Motors					
Rated Motor HP	% Starting Torque	Starting HP	Flow Charge		Max. Time in Sec
			Lbs.	Oz.	
2	100% @ 875 RPM	2.0	2	0	1000
	125% @ 870 RPM	2.5	2	2	1000
	150% @ 850 RPM	2.9	2	10	890
	175% @ 840 RPM	3.4	2	14	750
	200% @ 820 RPM	3.7	3	3	669
3	100% @ 875 RPM	3.0	2	9	862
	125% @ 870 RPM	3.7	3	2	669
	150% @ 850 RPM	4.4	3	7	475
	175% @ 840 RPM	5.0	3	11	310
	200% @ 820 RPM	5.6	4	0	297

Table 2: Thermal Capacity for No. 9D Flexidyne Drive

Starting HP	Maximum Allowable Acceleration Time in Seconds for Standard Motor Speeds at Various Starting Cycles											
	2 Hours			1 Hour			30 Min.			15 Min.		
	870	1160	1750	870	1160	1750	870	1160	1750	870	1160	1750
2.5	1000	....	....	1000	....	....	820	....	....	600	....	....
5.0	310	230	....	310	230	....	260	230	....	180	190	....
9.1	220	166	....	220	166	....	180	166	....	130	135	....
10.0	....	150	135	....	150	135	....	150	135	....	120	118
15.0	....	120	76	....	120	76	....	120	76	....	100	66
17.5	....	110	64	....	110	64	....	110	64	....	92	55
20	....	....	52	....	....	52	....	....	52	....	....	45
25	....	....	40	....	40	....	....	40	....	....	35	22
30	....	....	26	....	....	26	....	....	26	....	....	18
35	....	....	21	....	....	21	....	....	21	....	....	15
38	....	....	16	....	....	16	....	....	16	....	....	....
	10 Min.			5 Min.			2 Min.			1 Min.		
	870	1160	1750	870	1160	1750	870	1160	1750	870	1160	1750
2.5	425	....	....	225	....	....	96	....	....	45	....	....
5.0	140	160	....	70	100	....	27	42	....	13	22	....
9.1	100	110	....	50	72	....	20	29	....	10	15	....
10.0	....	100	100	....	65	70	....	26	28	....	13	14
15.0	....	85	58	....	50	38	....	21	15	....	11	7
17.5	....	78	48	....	47	31	....	19	12	....	9	6
20	....	....	38	....	....	25	....	....	10	....	....	5
25	....	....	30	....	....	20	....	....	8	....	....	4
30	....	....	18	....	....	12	....	....	5	....	....	....
35	....	....	15	....	....	10	....	....	4	....	....	....
38	....	....	13	....	....	9	....	....	3	....	....	....

REPLACEMENT OF PARTS

DISASSEMBLY

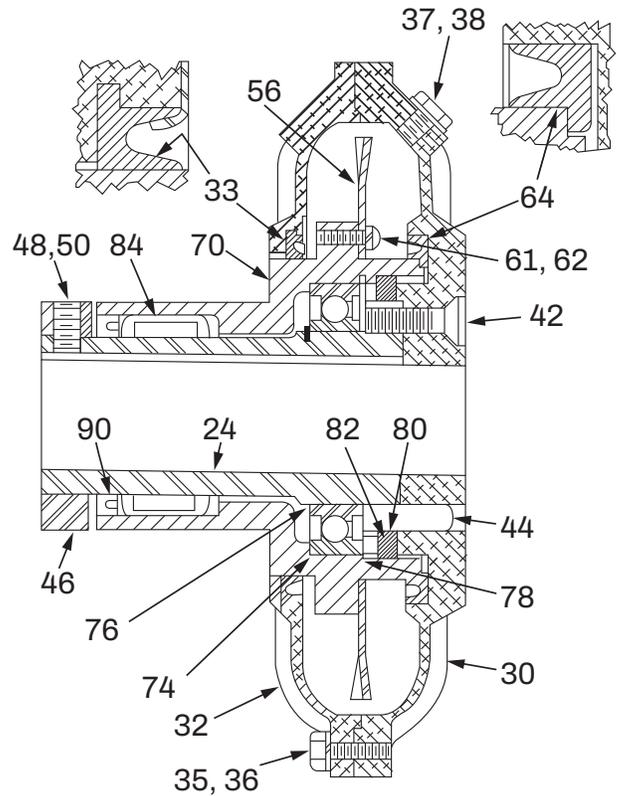
1. Loosen set screws in collar and remove Flexidyne Drive from motor shaft.
2. Remove filler plug and drain flow charge from Flexidyne.
3. Remove housing screws and remove housing cover. Remove cover seal retainer by inserting a small pin in the holes for the drive screws and tapping on rod to remove drive screws. Remove cover seal.
4. Remove the four drive hub screws and remove the drive housing. Remove housing seal.
5. Remove seal felt and seal shield from driven hub. Remove rotor.
6. Remove collar, outer ball bearing snap ring, and slide driven hub off drive hub.
7. Remove inner ball bearing snap ring and remove ball bearing.
8. To remove roller bearing from driven hub, place a plug in the right hand end (as viewed in the drawing) of the driven hub and press on plug to remove bearing and seal.

REASSEMBLY

1. Press roller bearing into driven hub. Left hand end of roller bearing should be $\frac{1}{4}$ " from left hand end of driven hub. Bearing should be completely filled with high temperature roller bearing grease. Tap needle bearing seal into place, flush with end of driven hub.
2. Press ball bearing onto drive hub, pressing against inner (not outer) race of ball bearing. Install inner ball bearing snap ring.
3. Slide drive hub into driven hub. Press against bearing not drive hub. Be careful not to damage needle bearing seal with any sharp edge on the drive hub during assembly.
4. Install outer ball bearing snap ring, seal shield, seal felt and motor shaft collar.
5. Place rotor in position on driven hub. Install and tighten rotor screws.
6. Stand Flexidyne on collar end and place housing seal (red in color) in position on end of driven hub.
7. Using dowel pins as guides place drive housing in position and lap gently until housing starts to pass over housing seal. The seal may tend to cock. A wire or other blunt probe may be used to push outer corner of seal into position in drive housing. Rotating the driven hub may also help to position the seal properly. When seal is properly positioned tap drive housing into place. Install and tighten the four drive hub screws.
8. Install cover seal (gray in color) in drive housing cover. Line up holes in seal retainer with holes in cover and install drive screws.
9. Place cover in position on drive housing so that filler plugs are diametrically opposed. Install and tighten housing screws.
10. Install filler plug. Tighten to recommended torque of 200 in.-lbs.

Reference	Name of Part		No. Required	Part Number
24, 30, 42, 44 ①	Drive Hub and Housing Assembly	1-1/8" Bore 1-1/4" Bore 1-3/8" Bore 1-5/8" Bore	1	391282 391283 391284 391285
32 33	HOUSING COVER AND SEAL ASSEMBLY ② ③ Housing Cover ③ Cover Seal (Gray Color) with Retainer and Drive Screws		1 1 1	391457 309080
35 36	Housing Screw Lockwasher		6 6	411039 419009
37 38	Filler Plug Filler Plug Lockwasher		2 2	308021 419121
42 ② 46	Drive Hub Screw Drive Hub Collar		4 1	415064 309020
48	Key Set Screw	1/8" & 1/4" Bores 13/8" Bore 15/8" Bore	1	400094 400090 400086
50	Shaft Set Screw	1-1/8" & 1-1/4" Bores 1-3/8 1-5/8	1	400098 400094 400090
56 61 62	Rotor Rotor Screw Lockwasher		1 6 6	309006 415106 419009
64 70	Housing Seal Driven Hub		1 1	309036 309005
74	Ball Bearing	Z993L11 ④ 6011 2RS ⑤	1	391210
76 78 80 82 84 90 ⑥	Ball Bearing Inner Snap Ring Ball Bearing Outer Snap Ring Seal Felt Seal Shield Needle Bearing – B-3424 ⑦ Needle Bearing Seal Driven Hub Key		1 1 1 1 1 1 1	421013 421026 309024 309027 426026 434002 443042

REPLACEMENT PARTS FOR NO. 9D FLEXIDYNE DRIVE



- ① Drive Hub (24) and Drive Housing (30) are fitted and must be ordered together.
- ② Includes parts listed immediately below.
- ③ Parts marked make-up the assemblies under which they are listed.
- ④ New Departure Part Number
- ⑤ SKF Part Number
- ⑥ Not shown on drawing.
- ⑦ Tarrington Part Number. Included in Drive Hub and Housing Assembly.

Flexidyne Mechanism Trouble Analysis		
Symptom	Cause	Cure
Vibration	<ol style="list-style-type: none"> Misalignment Bent shaft Excess flow charge Fused flow charge Improper installation – Output shaft jammed against housing 	<ol style="list-style-type: none"> Realign drive or coupling. Replace or straighten. Remove small amount of flow charge. Correct the overload. Readjust spacing between shafts and Flexidyne housing.
Erratic Acceleration	<ol style="list-style-type: none"> Breakdown of flow charge Caked flow charge 	<ol style="list-style-type: none"> Replace flow charge. Moist environment – use stainless flow charge.
Flexidyne Mechanism Doesn't Slip	<ol style="list-style-type: none"> Improper installation – Output shaft jammed against housing 	<ol style="list-style-type: none"> Readjust spacing between shafts and Flexidyne housing.
Excessive Slippage	<ol style="list-style-type: none"> Not enough flow charge Overload Worn flow charge Worn rotor 	<ol style="list-style-type: none"> Add flow charge. Relieve overload Replace flow charge. Replace rotor.
Poor or short flow charge life	<ol style="list-style-type: none"> Excessive slip at start up Excessive inching or jogging of machine 	<ol style="list-style-type: none"> Add flow charge to reduce starting time. Install time delay in motor control circuit.

Flexidyne Mechanism Flow Charge Analysis	
Condition	Cause
<ol style="list-style-type: none"> Red oxide color, granular consistency Red oxide color, powdery consistency, possibly with powdery flakes Black, powdery Red oxide, powdery and chunky Clumping of flow charge 	<ol style="list-style-type: none"> Normal after some usage. Worn-out, can cause Flexidyne mechanism damage. Rotor worn, excessive slip and heat. Worn-out and moisture present. Moisture present, use stainless flow charge.

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