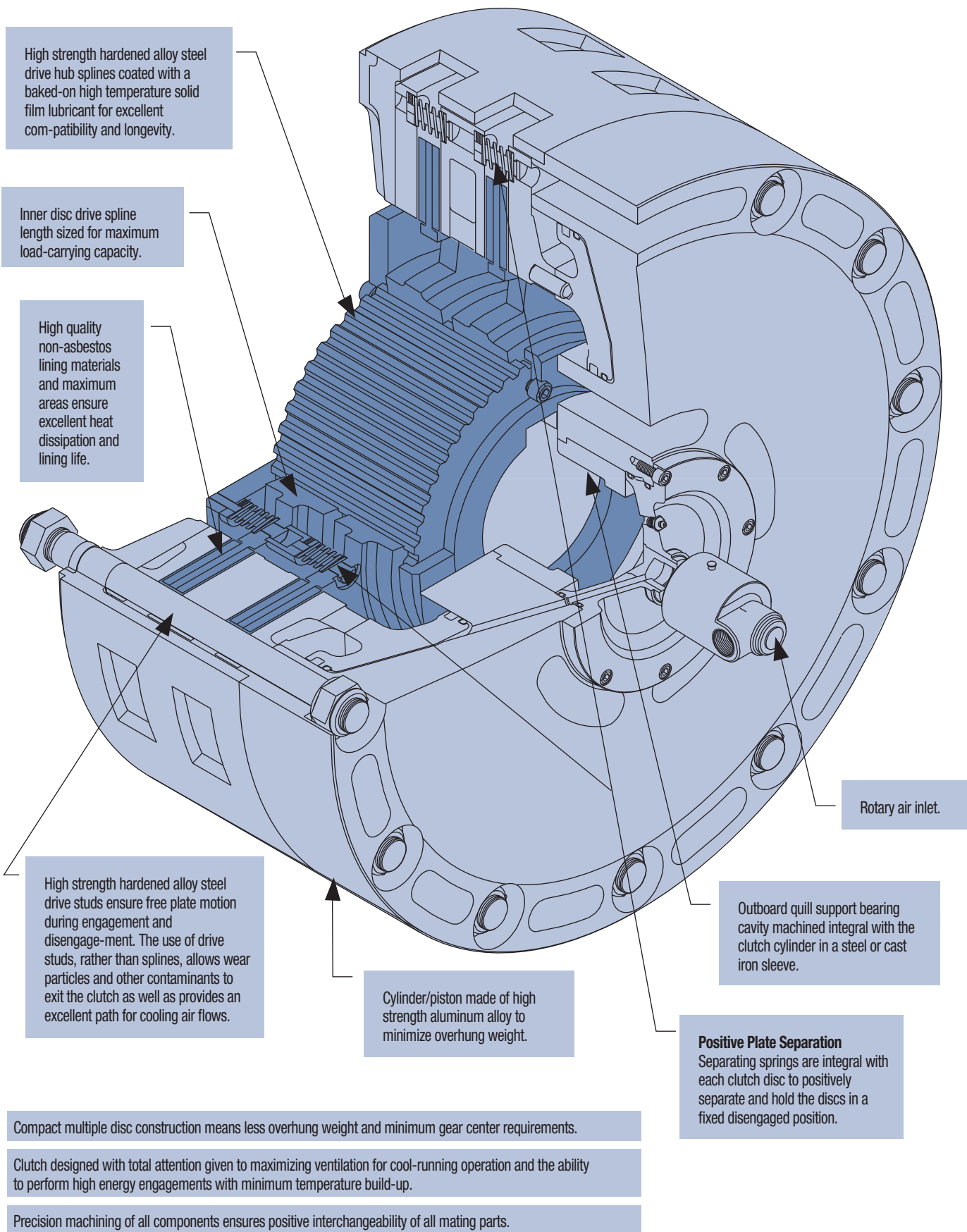




MODEL LKM

Air Set Marine Clutches

LKM Clutch Design Features



LKM Clutch Design Features

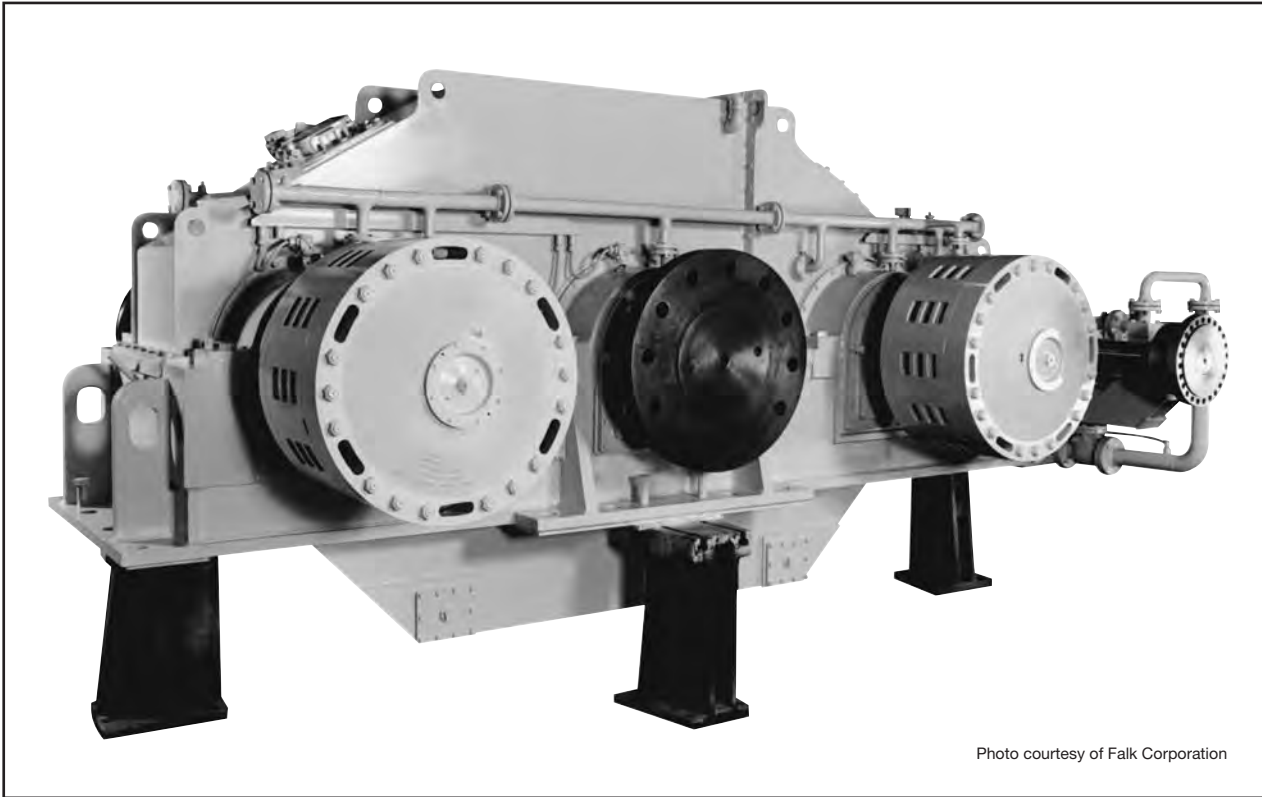


Photo courtesy of Falk Corporation

Model LKM-330-B clutches, each rated 5250 HP @ 500 RPM connect dual engine inputs to a single propeller on a Falk Model 55 x 20 DMA1-S marine gear.

LKM AIR SET MARINE CLUTCH DEVELOPMENT HISTORY

The Model LKM marine clutch incorporates many of the features found in our Model LK clutch series with some notable exceptions. Cyclic applications, where the LK style finds its most frequent use, contain duty cycles which bear little resemblance to marine main propulsion service. Marine clutches are required to make infrequent, yet in some instances, severe engagements from a heat standpoint. The clutches are also called upon to run for extended periods in the engaged position (ahead clutches) and for extended periods in the disengaged position (reverse clutches).

The Model LK clutches were rugged enough to handle the load duty cycle from a torque and heat standpoint but required modification to their separation systems in order to be suitable for marine service. Industrial Clutch Products was the first to recognize the importance of positive plate separation for marine service and all clutches installed in marine service contained this feature. Disc clutches for marine service without positive plate separation have experienced a sad approval rating from users.

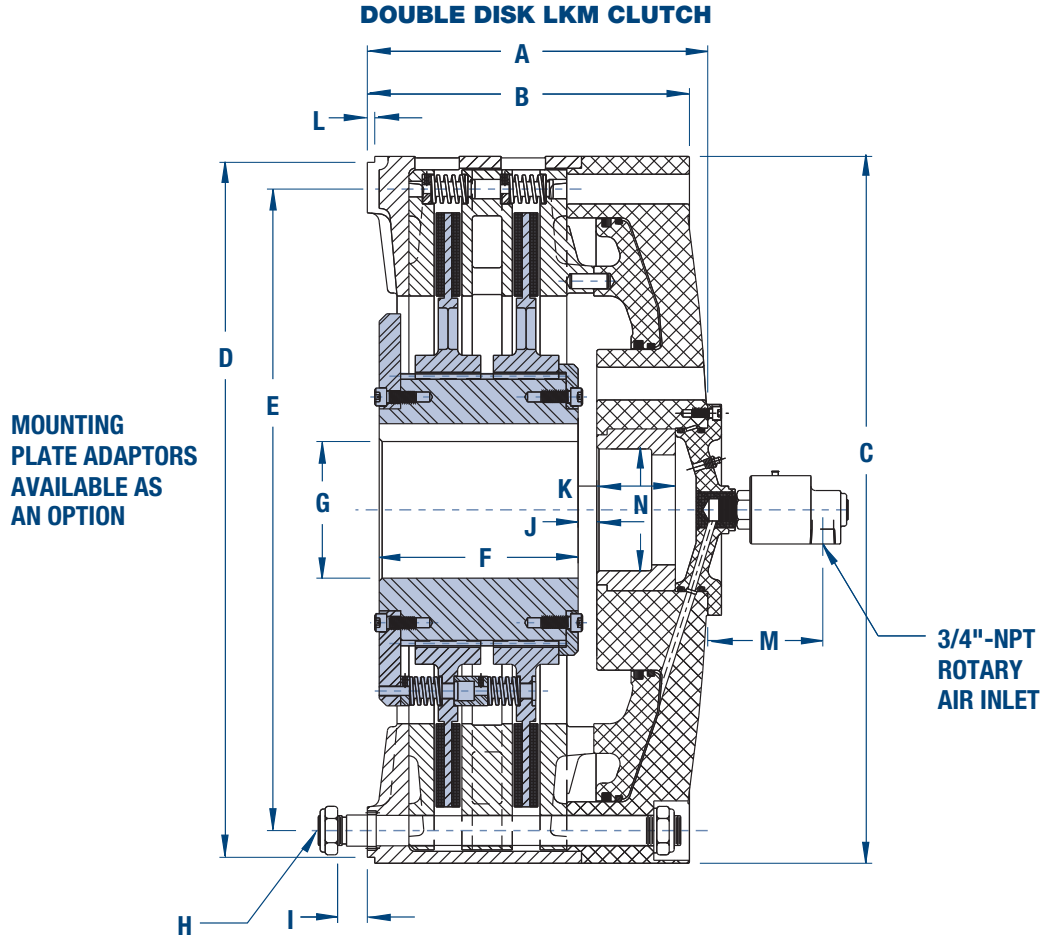
This is particularly true in forward/reverse service where, strangely enough, the unloaded reverse clutch gives the greatest degree of trouble. Because of the gearing arrangement, the outer members of this clutch rotate in

one direction while the inner member rotates in the other. This gives rise to the term "twice relative rotation." The cant of the gear to which these clutches are mounted in order to align with the propeller shaft as well as vessel motion due to wave action causes the clutch plates, if not positively separated, to kiss and wear or burn-out. Exactly the same result would occur if one were going down the road in an automobile at a high rate of speed with the brake pedal lightly depressed.

To eliminate this, Industrial Clutch Products designed and patented positive plate separation which has accrued over 30 years of field experience in marine main propulsion service. The separating system is self-adjusting for wear and no adjustments are ever required by the user during regular use or during routine maintenance. No plate contact can occur with this unique positive plate separation system and the many advantages of the disc clutch can be fully realized for marine service.

The incorporation of positive plate separation, a bearing cavity for the outboard quill bearing, and modifications made to increase the load carrying capacity on a continual basis changed the time-proven LK design into the Model LKM marine clutch.

Model LKM



DIMENSIONAL DATA

All dimensions in inches

LKM Model	A	B	C	D	E	F	G Min.-Max.	H No.-Size	I	J	K	L	M	N Min.-Max.
LKM-213	8.69	7.86	16.63	16.25	14.65	5.25	2-7/8 - 3-1/2	8-15/16	1	.44	1.50	.18	4	3-1/2 - 4-3/8
LKM-313	10.50	9.69	16.63	16.25	14.63	7.06	2-7/8 - 3-1/2	8-15/16	1	.44	1.50	.18	4	3-1/2 - 4-3/8
LKM-218	11.31	10.31	22.63	21.50	20.00	7.75	2-7/8 - 4-1/8	12 - 1-1/16	1	.56	1.38	.18	4	4-1/2 - 5-9/16
LKM-318	14.19	13.19	22.63	21.50	20.00	10.63	2-7/8 - 4-1/8	12 - 1-1/16	1	.56	1.38	.18	4	4-1/2 - 5-9/16
LKM-221	11.06	10.44	25.00	24.50	22.50	6.81	3-3/8 - 5-1/2	12 - 1-1/16	1	.31	2.19	.18	4	4-1/2 - 5-15/16
LKM-321	13.63	13.00	25.00	24.50	22.50	9.38	3-3/8 - 5-1/2	12 - 1-1/16	1	.31	2.19	.18	4	4-1/2 - 5-15/16
LKM-225	14.38	13.63	29.75	29.25	27.00	8.50	4-5/8 - 7-1/2	12 - 1-5/16	1-1/4	.78	3.31	.18	4	4-1/2 - 6
LKM-325	17.63	16.86	29.75	29.25	27.00	11.75	4-5/8 - 7-1/2	12 - 1-5/16	1-1/4	.78	3.31	.18	4	4-1/2 - 6
LKM-230	15.63	13.25	35.50	35.00	32.00	9.00	5-1/4 - 9-5/8	12 - 1-1/4	2	1.06	3.06	.25	4-5/8	5 - 8
LKM-330	18.94	16.56	35.50	35.00	32.00	12.25	5-1/4 - 9-5/8	12 - 1-1/4	2	1.06	3.06	.25	4-5/8	5 - 8
LKM-235	15.63	13.38	41.50	40.75	36.88	7.69	8 - 12	24 - 1-1/4	2	1.13	3.88	.25	3-7/8	6 - 9-1/16
LKM-335	18.06	15.81	41.50	40.75	36.88	10.13	8 - 12	24 - 1-1/4	2	1.13	3.88	.25	3-7/8	6 - 9-1/16
LKM-242	18.27	16.58	48.75	48.00	44.00	10.75	8 - 12	24 - 1-3/4	3	1.00	4.00	.25	3-7/8	6-1/2 - 9-1/16
LKM-342	22.13	20.44	48.75	48.00	44.00	14.63	8 - 12	24 - 1-3/4	3	1.00	4.00	.25	3-7/8	6-1/2 - 9-1/16
LKM-248	21.02	18.77	54.75	54.00	50.00	11.56	9-1/8 - 14	24 - 1-3/4	3	1.38	5.00	.25	2-3/4	10 - 14.50
LKM-348	25.50	23.25	54.75	54.00	50.00	16.00	9-1/8 - 14	24 - 1-3/4	3	1.38	5.00	.25	2-3/4	10 - 14.50

NOTES: 1.) Use certified drawing dimensions only for final layouts.

2.) DXF and IGES files available upon request.

3.) Dimensions subject to change without notice.

4.) Consult factory or refer to application information when selecting

units.

Model LKM

LKM Marine Clutch Application Information

The selection chart on the previous page is suitable for forward/reverse main propulsion service at 125 PSI actuation.

For controllable pitch propellers, dredge pumps, winches, and fire pumps use the following service factors.

Machinery	Service Factor
Main Propulsion Cont. Pitch Prop.	1.8
Winches, Centrifugal Fire Pumps	1.65
Centrifugal Dredge Pumps	2.5
Main Propulsion Continuous Slip from Engine Idle	Consult Factory

Example: Centrifugal dredge pump Disconnect clutch application.

Input Parameters

The engine is rated 3000 HP and the shaft the clutch is to be mounted on is rotating at 900 RPM. The available air pressure is 150 PSIG.

$$\text{Working Torque} = \frac{\text{HP} \times 63025}{\text{RPM}} = \frac{3000 \times 63025}{900} = 210083 \text{ LBIN}$$

$$\text{Minimum Static Torque} = \text{Work Torque} \times \text{Service Factor} \\ = 210083 \times 2.5 = 525208 \text{ LBIN}$$

$$\text{Minimum Catalogue Rating} = \text{Static Torque Req'd} \times \frac{\text{Rated Press}}{\text{Supply Press}}$$

$$\text{Minimum Catalogue Rating} = 525208 \times \frac{125}{150} = 437674 \text{ LBIN}$$

The Model LKM-225-B (rated at 510,000 LB-IN) is selected from the static torque column shown in the operational data chart on the previous page. This unit is the nearest size that meets or exceeds the value of 437,674 LB-IN required.

The allowable speed for the Model LKM-225-B is 1200 RPM and exceeds the operating speed of 900 RPM. The selection is appropriate from a torque and speed standpoint.

Dredge pumps can draw extraneous matter into the pump which may suddenly stall the pump impeller. This places a huge shock on the drive system and the clutch is called upon to act as a fuse in these instances. A review of the magnitude of the actual applied service factor is always required to be certain the drive system components can withstand these overloads. It may be necessary to reduce the clutch service factor which increases the likelihood of clutch damage but saves a more costly drive system repair.

The preferred way to reduce the service factor is to adjust the operating air pressure accordingly and maintain the clutch size as originally selected.

The following procedure may be used to calculate the air pressure required for any desired service factor. In this example, the recommended service factor was 2.5. We selected a Model LKM-225-B clutch since it was the closest unit that met or exceeded the calculated torque requirement of 437,674 LB-IN. Note that the actual service factor is 2.91.

$$\text{Tact} = \text{Actual Static Capacity} = \text{Cat. Stat. Rating} \times \frac{\text{Supply Press}}{\text{Rated Press}}$$

$$\text{Tact} = 510000 \times \frac{150}{125} = 612000 \text{ LBIN}$$

$$\text{Actual Serv. Fact.} = \frac{\text{Tact}}{\text{Working Torq}} = \frac{612000}{210083} = 2.91$$

If, by way of example, it was decided that a service factor of 2.0 was required, the supply air pressure should be set at 103 PSI.

$$\text{Operating Pressure} = \frac{125 \times \text{Reqd. Serv. Fact.} \times \text{Work Torq}}{\text{Cat. Stat. Torq. Rating}}$$

$$\text{Operating Pressure} = \frac{125 \times 2.0 \times 210083}{510000} = 103 \text{ PSIG}$$

To summarize, a Model LKM-225-B operating at 103 PSIG will provide a 2.0 service factor for this application.