



JSL INDUSTRIES LTD.

“Jyoti” Oil-Immersed Star Delta Starters

Introduction

Standard Designs

Construction & Method of Operation

Technical Specifications

Starting & Operating Characteristics

Advantages

Range of Applications



JSL INDUSTRIES LTD.

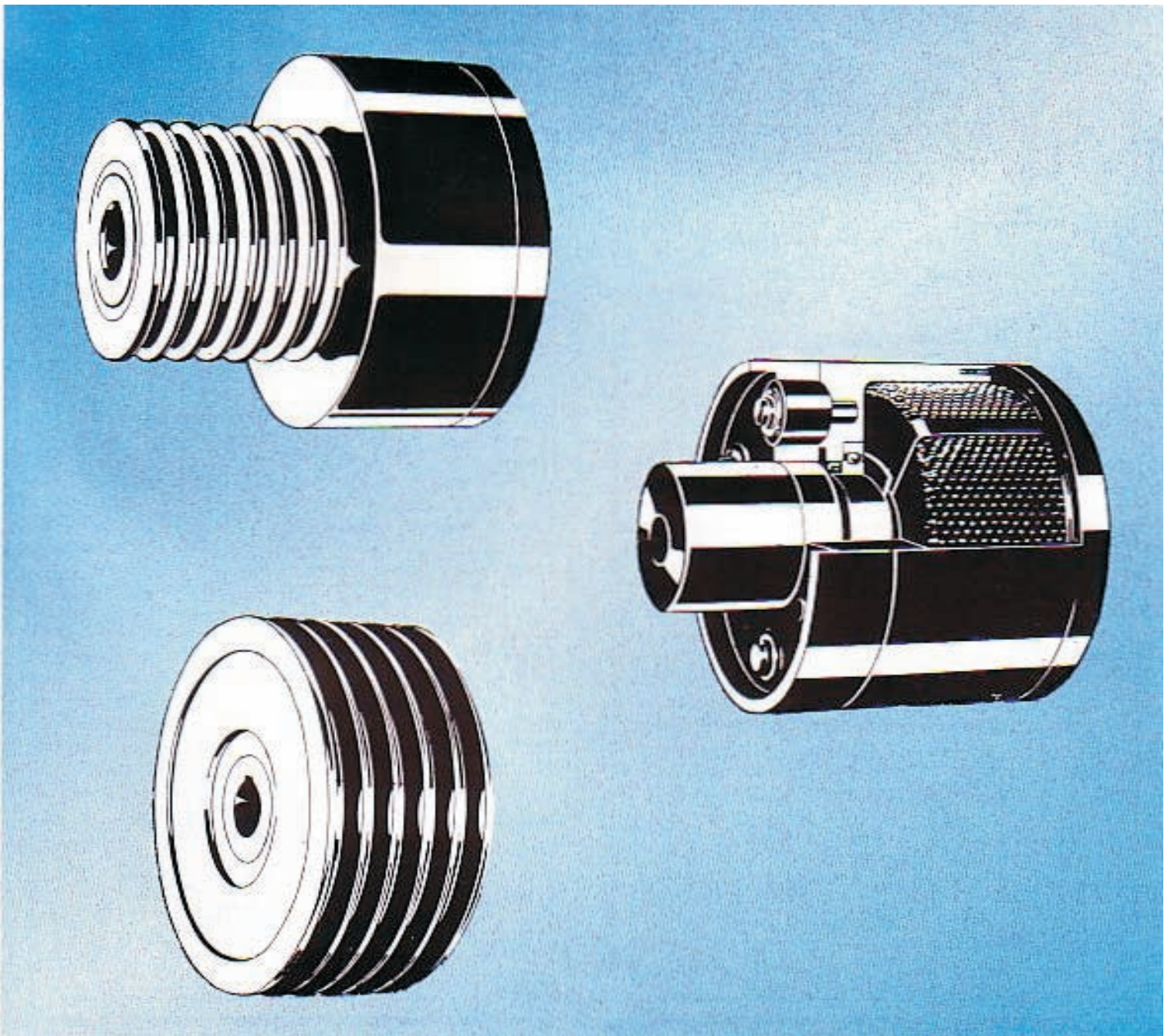
Manufactured in Technical Collaboration with

METALLUK

BAUSCHER GMBH+CO.KG

BAMBERG, GERMANY

'Jyoti' Starting and Safety Dry Fluid Coupling



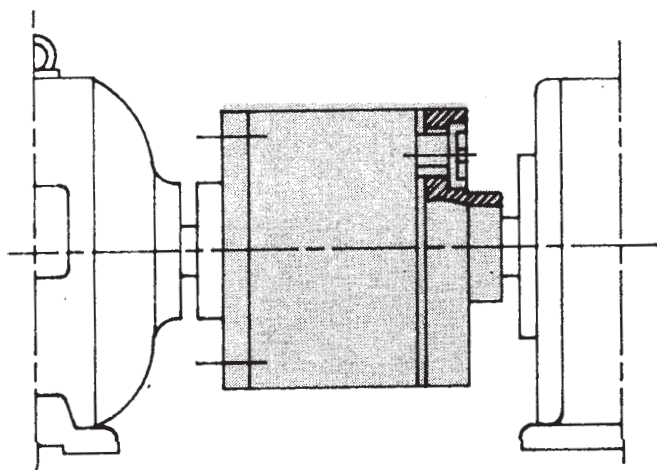
A Dry Fluid Coupling with 100% Transmission Efficiency

Models of 'Jyoti' starting and safety coupling

If the following standard designs do not meet your requirements, please let know your cases since we can also supply couplings of special designs.

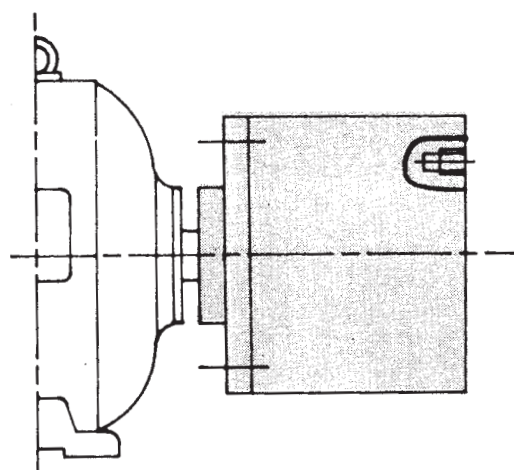
Type K

For Coupling two shafts using coupling with bolting arrangement



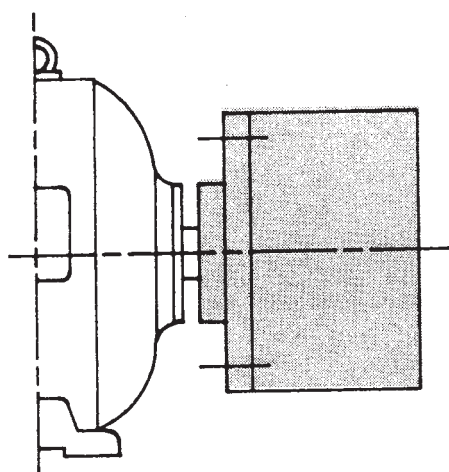
Type G

For Coupling driven machine with flange coupling



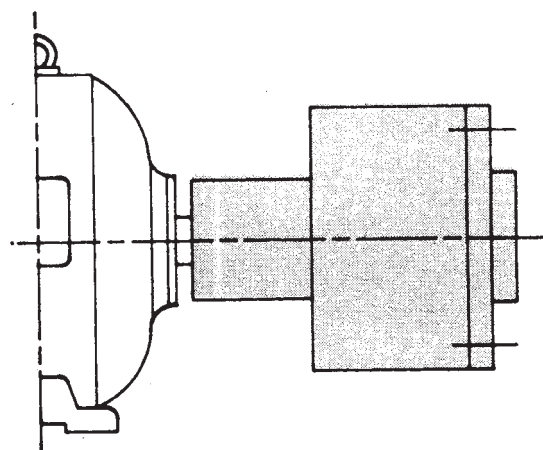
Type S

Coupling having flat belt pulley



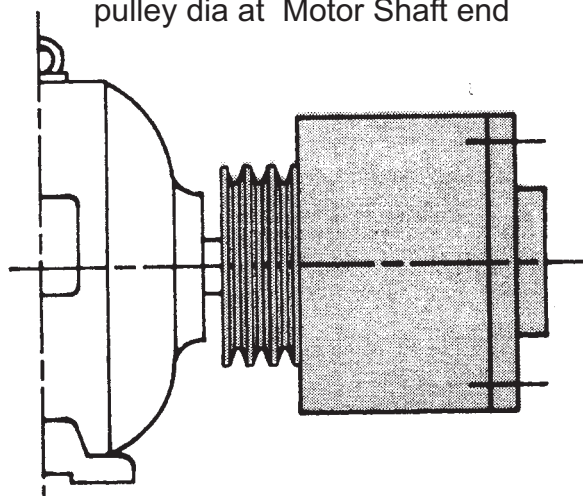
Type VN

Coupling having smaller dia.flat belt pulley near the Motor Shaft end



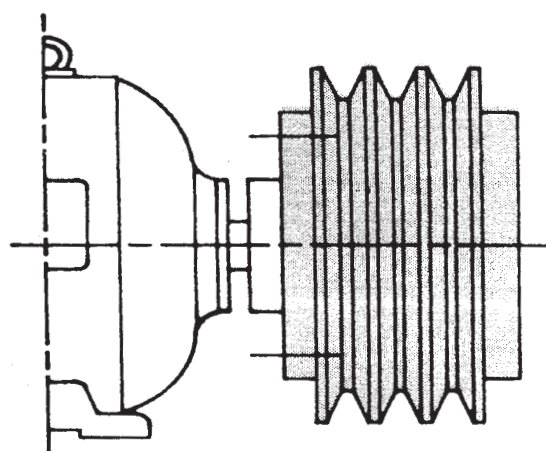
Type SKS

Coupling having smaller V-belt pulley dia at Motor Shaft end



Type SKA

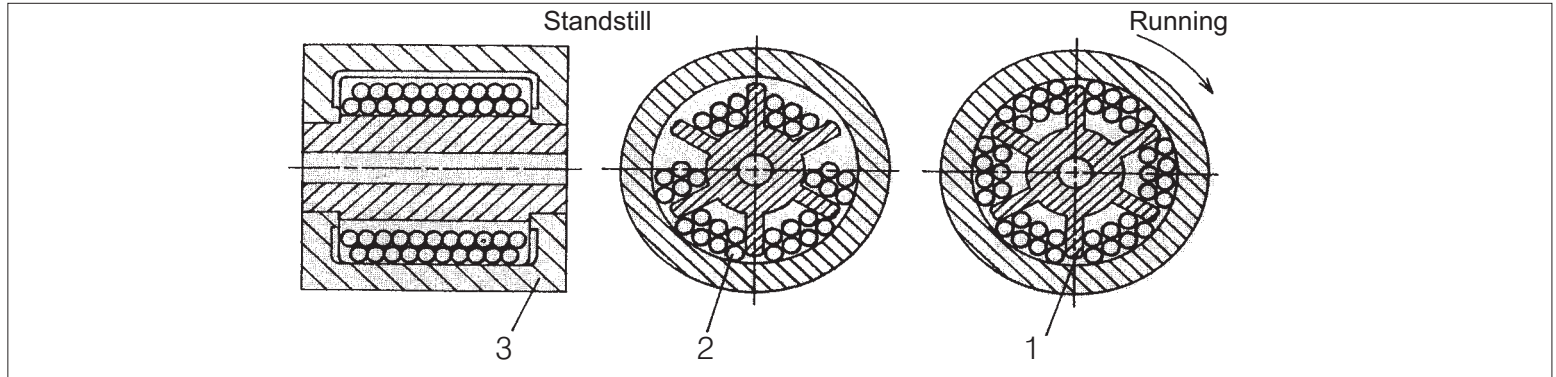
Coupling having V-belt pulley



A Dry Fluid Coupling with 100% Transmission Efficiency

The rugged design and simple method of JYOTI coupling does not create any assembly or operational problem.

Construction and method of operation of 'Jyoti' starting and safety coupling



Construction

'JYOTI' Coupling comprises of three main components which are simple and rugged construction as shown in the above diagram.

- Part 1 : Hub with paddle wheel which is a Primary part
- Part 2 : Steel balls as centrifugal force producing Elements
- Part 3 : The housing of the coupling forms a secondary Part

The hub which is built like a wheel is tightly fitted on the Motor Shaft. The space between paddle wheel arms is filled with steel balls to attain equal weight distribution. Further, the steel balls are lubricated with special gear oil. The housing which is made of steel is mounted on the hub of the paddle wheel with bearings. Depending upon the application requirement, coupling with various housing arrangements can be selected as shown in coupling model on page 2.

Anti-friction bearings are used in the couplings to cater to higher radial loadings occurring due to belt tensions in some of the application. Also same are being provided in the couplings used in vertical application. However, in the Couplings where no extra stresses are coming on the bearing, are provided with sliding

Coupling Designation System

'JYOTI' Coupling are designated on the basis of the following parameters :

- (A) Coupling type : K/G/S/VN/SKS/SKA
- (B) Coupling size : 215-----800
(Dia.in mm)
- (C) Coupling length : /1(short) or (long) /2
- (D) Special duty :
- /Z housing design for longer starting time or for frequent starts.
- /V housing design for the speed higher than 2200 RPM or for extremely high slip stresses.

FOR EXAMPLE : K-615/2/Z

Method of operation

The star shaped paddle wheel which is permanently fixed to the drive shaft divides the housing into compartments of equal volumes. These compartments are completely or partly filled with steel balls depending upon the required coupling power.

At standstill, the primary and secondary parts (paddle wheel and coupling housing) of coupling can move relative to each other. When the drive shaft is rotated, the steel balls will be made to travel away from the shaft centre. The resulting centrifugal force will produce a pressure against the housing. During starting time i.e run up time, the steel balls come in contact with housing due to centrifugal force and in turn makes it also to rotate due to rolling friction with slip. At the end of starting time, due to high pressure generated on the housing by steel balls, it attains the same speed of paddle wheel. In other words, after string time, there will not be any slip.

The steel balls are lubricated with special gear box oil which occupies the remaining volume. The shaft sealing rings are provided to prevent oil leakage.

The natural wear on the steel balls and the housing is negligible as rolling friction takes place only during starting time. This means that the couplings require hardly any maintenance.


A Dry Fluid Coupling with 100% Transmission Efficiency


Starting power $P_A = \text{Rated motor power } P_N \times \text{The operation Factor } f$. (Unless otherwise specified).

Starting power of the 'Jyoti' coupling

Size of coupling	dM Max. mm	Filling material		Starting power P_A at						
		Dia. mm	Max. Weight kg.	570rpm kW	710rpm kW	970rpm kW	1160rpm kW	1440rpm kW	1750rpm kW	2880rpm kW
95	22	4 - 5	0,6	--	--	--	--	0.25	0.45	1.5
120	25	4 - 5	1,2	--	--	0,3	0,5	1	1,8	5,5
145	32	4 - 5	1,8	--	0,25	0,6	1,1	2,2	4	11
165/1	42	5 - 6	2,1	0,2	0,45	1,1	1,8	3,5	5,5	18
165/2	42	5 - 6	3,9	0,37	0,7	1,8	3	6	10	30
215/1	55	5 - 6	4,5	0,75	1,5	4	6	12	22	60
215/2	55	5 - 6	6,6	1,1	2,2	5,5	9	18	33	90
265/1	65	6 - 7	7,8	2	4	10	17	33	58	150
265/2	65	6 - 7	11,7	3	6	15	26	50	88	220
315/1	75	6 - 7	13,5	6	9	24	39	75	140	270*
315/2	75	6 - 7	20,1	7	14	35	60	115	200	400*
360/1	90	7 - 8	23,7	12	22	57	96	185	330	500*
360/2	90	7 - 8	36	17	33	88	145	280	500	700*
415/1	110	7 - 8	42	30	55	140	235	450	--	--
415/2	110	7 - 8	60	40	75	200	340	650	--	--
500/1	150	8 - 9	54	55	110	280	470	900*	--	--
500/2	150	8 - 9	81	83	160	400	600	1100*	--	--
550/1	160	8 - 9	93	110	210	550	900	1500*	--	--
550/2	160	8 - 9	126	160	290	750	1100	1500*	--	--
615/1	160	8 - 9	153	230	450	1100	1500*	1500*	--	--
615/2	160	8 - 9	264	400	750	1500	1800*	2200*	--	--
800/1	160	8 - 9	348	860	1700	2200*	2500*	3000*	--	--
800/2	160	8 - 9	492	1280	2200	3000*	3500*	4000*	--	--

Other sizes on request

 The sizes in colour blocks are only available in model Z and V

 For Type K with special flange, because peripheral velocity is higher than 36m/s.

$$P_1 / P_2 = (n_1 / n_2)^3$$

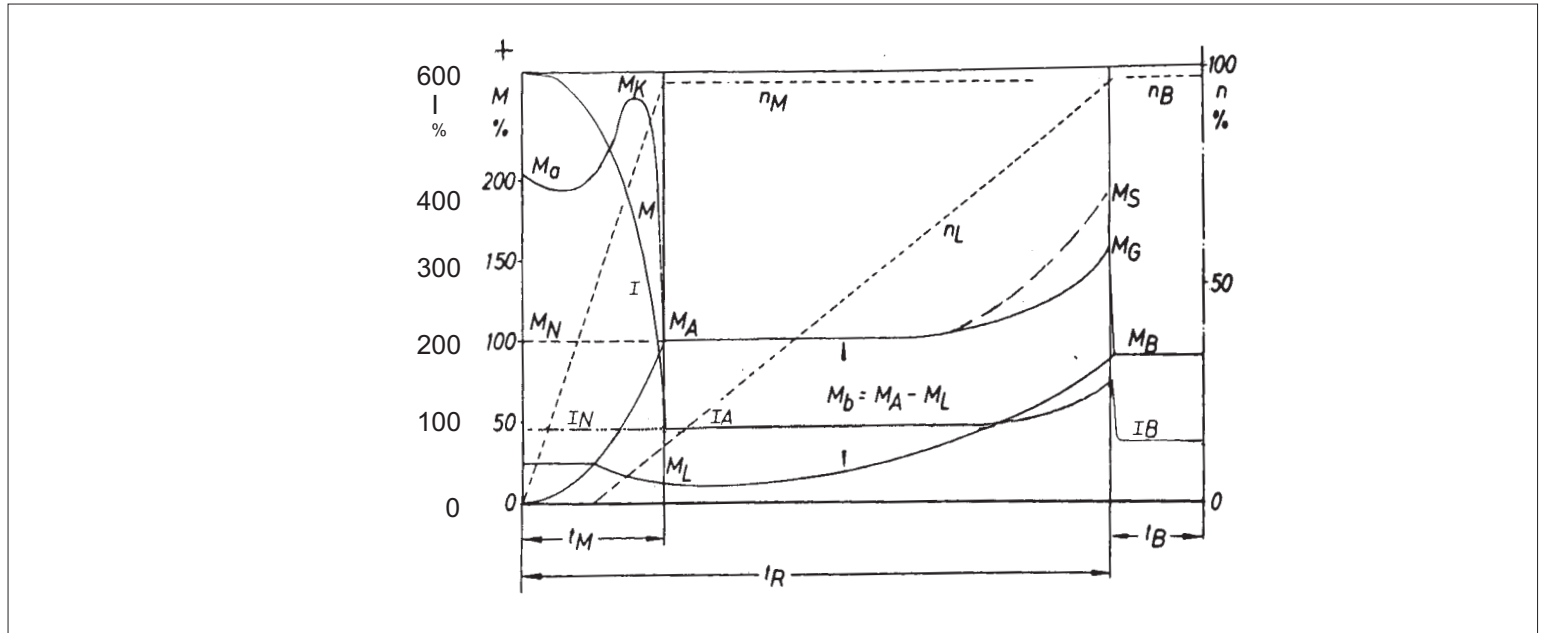
$$M_1 / M_2 = (n_1 / n_2)^2$$

'Jyoti' couplings can of course, be operated at other speeds besides those shown in the load table. When converting the starting power, it should be noted that the power varies according to the cube of the speed and the torque according to the square of the speed.

A Dry Fluid Coupling with 100% Transmission Efficiency

Current, torque and speed curves of heavy drives with directly switched on motor with short circuited rotor and 'Jyoti' starting and safety coupling.

Starting and operating characteristics of the 'Jyoti' starting and safety coupling



Typical time V/S speed, torque, Current Characteristics of squirrel cage induction Motor drive with DOL String method using 'JYOTI' Coupling.

————— current
 ————— Torque
 - - - - - Speed

- t_M = Current characteristics of the motor
- t_N = Rate current
- t_A = Starting current
- t_B = Operating current
- M_a = Starting torque of motor
- M_k = Balancing torque (maximum torque of motor)
- M_A = Starting torque of the coupling
- M_N = Rated Torque
- M_B = Operating torque
- M_G = Gripping torque
- M_s = Load torque
- M_b = Accelerating torque
- M_L = Load torque
- n_M = Motor speed
- n_L = Load speed
- n_B = Operating speed
- t_M = Starting time of the load
- t_R = Starting time of the load
- t_B = Operating time

Very favourable properties of JYOTI Coupling are illustrated in the description given below with the help of above characteristics diagram.

In order to give a better understanding of the motor along with coupling a large reference Motor Starting time is chosen as shown above. When JYOTI Starting and Safety Coupling is used, starting time t_M of the Motor remains almost the same as that of No load condition, even when heavy drive is considered. During this period t_M , Motor reaches to its rated speed n_m . Torque/Current V/S time characteristic upto rated value (M_N, I_N) are as shown in the diagram. During this period, coupling develops torque from zero to starting torque M_a which is in square proportion of the speed.

The starting torque M_a is obtained from the intersection between Motor Torque line and coupling Torque line. Depending on operational factor, this point will be located between rated torque and 1.8 times the rated torque of the motor. If the actual load torque required is less than that of rated torque of the motor, then smaller starting torque of the coupling would be required. The point of intersection (M_a) should not be before Maximum Torque (M_k), since motor is coupled with the load. This phenomena should be checked specifically in case of Star-Delta Starting.

A Dry Fluid Coupling with 100% Transmission Efficiency

Advantages of the 'Jyoti' starting and safty coupling

- Allows Motor to start under NO load and loaded gradually after attending speed even for the loaded or blocked driven machine.
- Ensures jerk-free and smooth acceleration of even heavy duty machine and heavy masses through a sq. Cage induction motor.
- Motor Starting current gets reduced in case Star/Delta and auto transformer starting methods are used, in the applications where Motor starting torque requirement is insignificant.
- Protects Motors against overload as it allows transmission of designed torque value and slip beyond that if overloading takes place.
- Ensures 100% transmission efficiency and saving energy as there is no slip exists when operating at the rated speed.
- Can rotate in either directions at optimum torque and current. Also reverse current braking can be used when reversing the direction of rotation.
- High profitability by protecting all electrical and mechanical drive elements.
- Very quiet running, most rugged, compact and simple in construction as well as in operation.
- No special assembly involved.
- Practically maintenance - free running.

Starting time of load (t_R)

- As soon as coupling torque become greater than the load torque, the driven machine starts rotating and speed picks up smoothly depending upon accelerating torque M_B which is the different between coupling torque M_a and load torque M_L . Speed increases almost in liner proportion form zero to rated speed of Motor. String time depends upon size of the mass to be accelerated.

- As the difference between motor speed n_m and drive machine speed n_{NL} become smaller, the coupling torque increases to gripping torque M_G . Hereafter coupling will operate totally slip free and the coupling torque would be equal to load torque reaching value M_b . At this moment acceleration process gets completed. The JYOTI Coupling will then operate without any loss in the output. It can be loaded, if required, upto safety torque M_s .

- This will be the end of the acceleration process. The 'Jyoti' coupling will then operate without any loss in output and can be loaded up to the safety torque M_s .

- The Current curve during the starting time is analogues to the torque curve. It is therefore quit clear, that when a 'Jyoti' coupling is installed the current will drop to near enough the rated value within a fraction of a second, without the starting period of the load reaching an unacceptable value, which is unlike the case with a direct coupling.

The motor starting current drops to value I_A within fraction of second as soon as Motor reaches to its full speed corresponding to torque M_A as shown in the diagram. The motor will draw full load current I_B when driven equipment attains full speed.

'Jyoti' coupling acting as a safety coupling when the system is overloaded.

If the operating torque M_b exceeds the safety torque M_s due to overload or blocking in the machine, in such an event coupling will start to slip and the torque will drop down immediately to the starting torque M_A . Thus, the motor will be protected from overloading and likely windings burn out.

The output of Jyoti Coupling does not depend on the direction of rotation. They are, therefore, very suitable for use in reversible drivers. It is even possible to put the drive fully in reversible direction in a single action i.e. Braking and accelerating in reverse direction upto full speed.

Apart from the short changeover current kick (for a fraction of a second) the Motor will only be loaded with the starting torque of the coupling or rated current during all the phases of the starting period which occurs when switching into reverse direction. The transition from acceleration to deceleration and vice versa is exceptionally smooth (very important feature for the drives used in hoists or drive mechanisms for equipment with floating loads). The very favourable operating property of Jyoti coupling can be used for rapid braking of the driven machines by switching on the motor and switching off totally before reaching the zero speed. However, In such applications a due consideration with regards to thermal stressing of the coupling to be given. The braking process is considered approximately equivalent to two start and reversing process is approximately equivalent to three number of starts.

A Dry Fluid Coupling with 100% Transmission Efficiency

Range of applications of 'Jyoti' Starting Safety Coupling

For Starting and driving the Machines with high Inertia such as:

Band Saws	Wood wool machines	Spinning machines
Biffarcog grinders	Teassels	Logging mills
Sheet bending machines	Kneading machines	Stamping tools
Lathes and planning Machines	Coal grinding molls	Dust separators
Excavators	Carding machine	Textile machines
Blowers	Cooling Drums	Drying drums
Generators	Stamping and crushing Mills	Transformer
Flower Mills	Bulk handling machines	Drives
Chaff blowers	Ripping machines	Ventillators
Drop forging mills	Saw mills	Fans
Pulp engines	Suction tool	Centrifuges

For the driven machines needing high starting torque such as :

Tanning machines	Grinding mills	Vaccum pumps
Glazing rollers	Rotary filters	Cording machines
Reciprocating Pumps	Turnip washers	Washing machines
Edge mills	Shaking troughs	Mangling machines
Compressors	Vibrating sieves	Cement mixers

For the driven machines with smooth starting requirements such as :

Hoists	Glass polishing machines	Shunting winches
Drills	Overhead conveyors	Spinning machines coil and winding machines
Wire drawing machines	Tracked conveyors	Grinding machines
Pulleys	Crane and tracked drives	Stone crushing machines
Rotary furnaces	Rotary pumps	Stretching machines (Textiles)
Winding machines	Porcelain turning	Tensioning drums
Milling machines	Refiners	
	Stools	

For the driven machines likely to be blocked during operation such as :

Dredger and pedal wheel drives	Meat grinders	Lifters
Bucket elevators	Worm conveyors	Stirring machines
Grinding mills	Veneering machines	Extrusion presses
Briquette presses	Wood polishers	Conveyor belts
Hopper and furnace	Scrapers	Machine tools
Locking mechanism	Mixers	Brick works
Rotary compressors	Packing presses	Machines
Elevators		