

PURCHASER's DATA

A. Site conditions

1	Ambient temperature, minimum:	1	°C	3	Atmospheric condition:	Humid & highly corrosive
	maximum:	39.8	°C	4	Altitude:	< 1000 m
	design:	40	°C R2	5	Location:	Outdoor
2	Relative humidity:	92	%	6		

B. Technical particulars

1	Motor tag no.:	117-PA-482	16	Hazardous area classification:	Zone 2
2	Driven equipment name:	PUMP	17	Gas group/Temp class:	IIB / T3 R1
3	Voltage:	415 V ±6% R2	18	Type of explosion protection:	Ex 'n'
4	Phase:	Three	19	Type of ingress protection:	IP 55
5	Frequency:	50Hz +/-3% R2	20	Color shade:	AAP Paint shade 632 as per IS : 5 R1
6	Fault level:	50kA for 0.25sec with fuse protection	21	Thermistors:	☒ Required ☐ Not required
7	Method of starting:	D.O.L.	22	RTD:	☒ Required ☐ Not required
8	Winding connection:	Delta	23	BTD:	☒ Required ☐ Not required
9	No. of terminals:	6	24	RTD/BTD monitoring device:	☒ Required ☐ Not required
10	Cable size:	1R X 3C X 6 sq. mm			
11	Cable type:	CU XLPE / PVC			
12	Temperature rise:	80 °C R1			
13	Cooling:	TEFC			
14	Insulation class:	Class F insulation with class B temp rise	25	Applicable specification:	EIL Spec : 6-51-0032 Rev. 4
15					

DRIVEN EQUIPMENT MANUFACTURER's DATA

1	Suggested motor rating:	5.5	kW	9	Torque required, starting:	0.254	Kg-m
2	Manufacturer:	M/s Bharat Bijlee Ltd			maximum:	1.27	Kg-m
3	BkW at full load:	2.03	kW	10	GD ² of eqpt., including flywheel:	0.0825	kgm ²
4	kW at end of curve:	3.85	kW		excluding flywheel:	-	kgm ²
5	Speed:	2920	RPM	11	Thrust, up:	-	kg
6	Rotation viewed from coupling end:	-			down:	-	kg
7	Driven equipment:	Pump		12	Starting condition:	Open discharge	
8	Coupling type:	Fleximetal spacer			valve condition		

MOTOR MANUFACTURER's DATA

1	Rating:	5.5	kW	17	Efficiency at, 75% voltage:	85	%
2	Manufacturer:	M/s Bharat Bijlee Ltd			100% voltage:	86	%
3	No. of poles:	2		18	Power factor at, starting:	0.26	
4	Frame designation:	132S (MN13S233)			100% load:	0.88	
5	Full load speed:	2920	RPM	19	Moment of inertia, GD ² :	0.069	kgm ²
6	Mounting:	B3		20	NDE bearing type & no.:	Ball / 6208ZZ C3	
7	Full load torque (FLT):	1.84	mkg	21	DE bearing type & no.:	Ball / 6208ZZ C3	
8	Starting torque:	230	% of FLT	22	Type of lubrication:	Grease	
9	Break down or pull out torque:	300	%	23	Weight of motor:	62	kg
10	Full load current (FLC):	10.1	A	24	Thermistors, quantity:	-	no.
11	Starting current at 100% voltage:	600	% of FLC		make:	-	type:
12	Rotation viewed from coupling end:	Bi-directional		25	RTD, quantity:	-	no.
13	Starting time at, 75% voltage:	2	sec.		make:	-	type:
	100% voltage:	1	sec.	26	BTD, quantity:	-	no.
14	Locked rotor withstand time (cold/hot) at, 75% voltage:	14	sec.		make:	-	type:
	100% voltage:	8	sec.	27	Shaft voltage:	NA	V
15	Space heater - voltage & power:	Not provided		28	Critical speed, 1 st /2 nd stage:	6000 / #	RPM
16	Applicable IS/IEC for hazardous area application:	IS/IEC 60079-15 (2005)		29	Canopy (FRP):	☒ Required ☐ Not required	
					Canopy in KEPL scope of supply:		R1

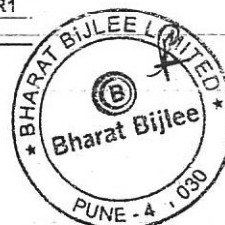
- Starting time calculations shall be based on operating conditions specified on Material Requisition eg. open valve condition/ closed valve condition, at no load/full load, as applicable.
 - All unfilled data shall be filled by Contractor / Vendor.
 - Separate datasheet shall be filled for each tag no of motor.
 - Canopy shall be provided for all out door motors.
- # Our rotors are stiff rotors as per clause 10.0 of EIL specification hence lower than synchronous speed no critical speed arise.

* All performance figures are subject to IS : 325 (1996) tolerances.

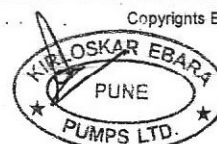
Rev : 2 by bmd on 09.12.2010.

Rev : 1 by bmd on 28.09.2010.

Prepared & approved by BMD for BBL on 09.09.2010.



A	16.11.09	ISSUED WITH MR	JDM	VKJ	AK
Rev. No.	Date	Purpose	Prepared by	Checked by	Approved by



LOAD Vs EFF., P.F.,

CUSTOMER

: KEPL

W.O. NO. C1565-05

SAP NO: 41830/50

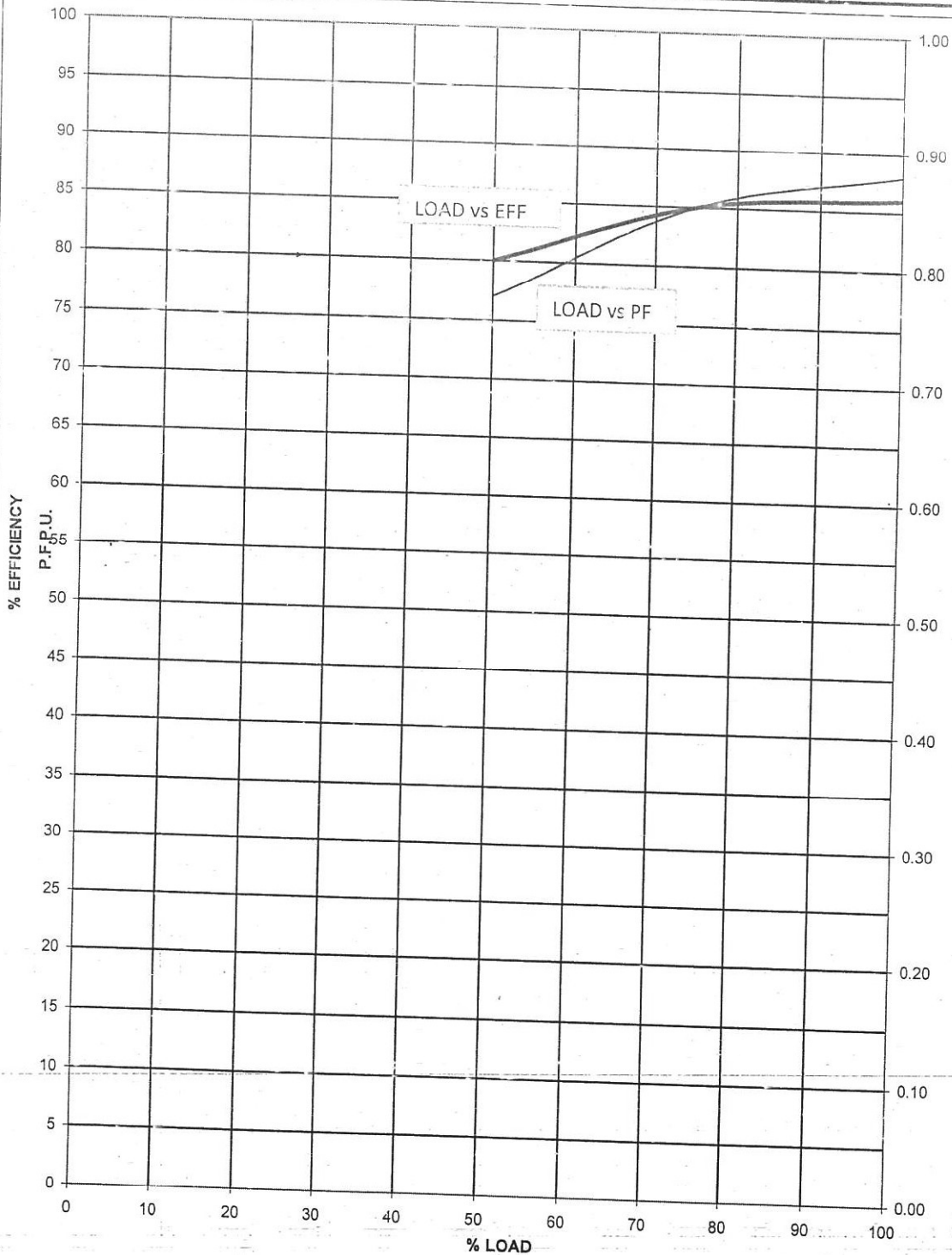
KW : 5.5

POLE : 2

VOLTS : 415

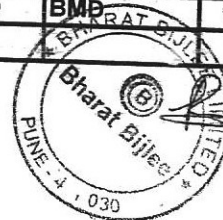
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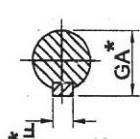
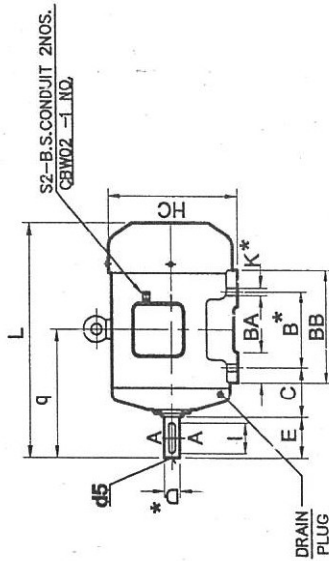
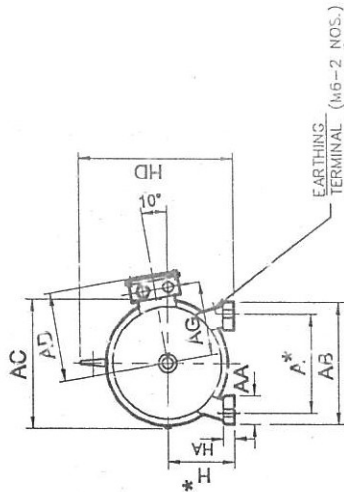
1



Cooper
Handwritten signature
27/11/11

2			PREP	BMD	1/11/2011
1	*		APPD	BMD	1/11/2011
NO	REVISION	SIGN			DATE





SECTION A-A

IEC Fr. size	Pole	FIXING										GENERAL										TERMINAL BOX					SHAFT				
		A	B*	C	H*	K*	AB	BB	AA	BA	HA	HC	HD	AD	L	AC	q	AG	S2	B.S.C.	D*	E	F*	GA*	I	d5					
132S	2	216	140	89	132	12	256	180	64	50	17	262	308	206	464	260	239	167	1*		38	83	10	41	70	M12					

TYPE REFERENCE-MN13S233
MOTOR RATING-5.5KW-2P

MOTOR TAG NO.117-PA-482

CCOE APP. CERTIFICATE NO: A/P/HQ/MH/104/1868 (P234446) DT. 29.07.10

CUSTOMER NAME : KEPL
PROJECT : BPCL
CONSULTANT : EIL

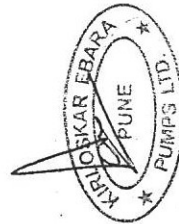
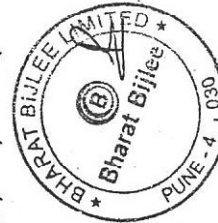
Tolerance on Dimensions with*

Dimension	Tolerance	Specification
A,B	±0.75	
H	-0.5	IS : 1231
K	+0.430	12#
D	±0.6	38#
GA,F		IS : 2048
d5(centering)		IS : 2540

OVERALL DIMENSIONAL DRAWING

NONSTD NO1 SPARKING (FOOT MOUNTED) MOTOR

MOTOR FR-SIZE 132S

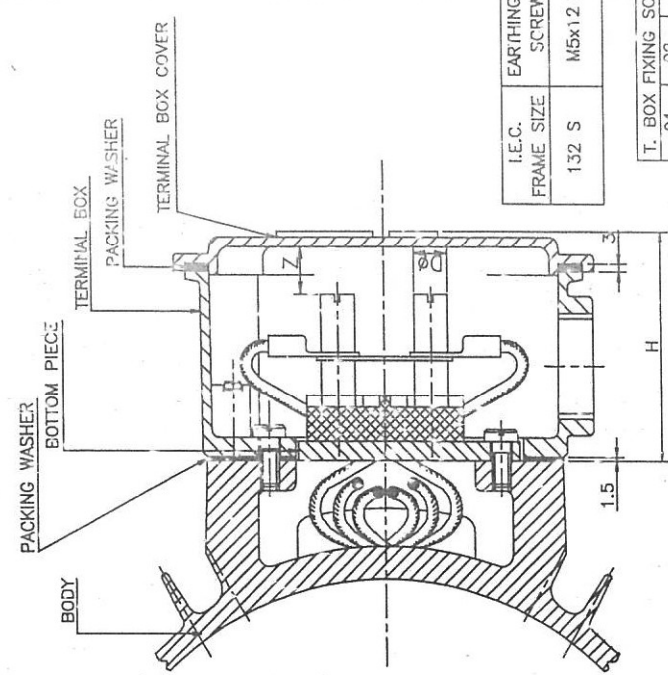
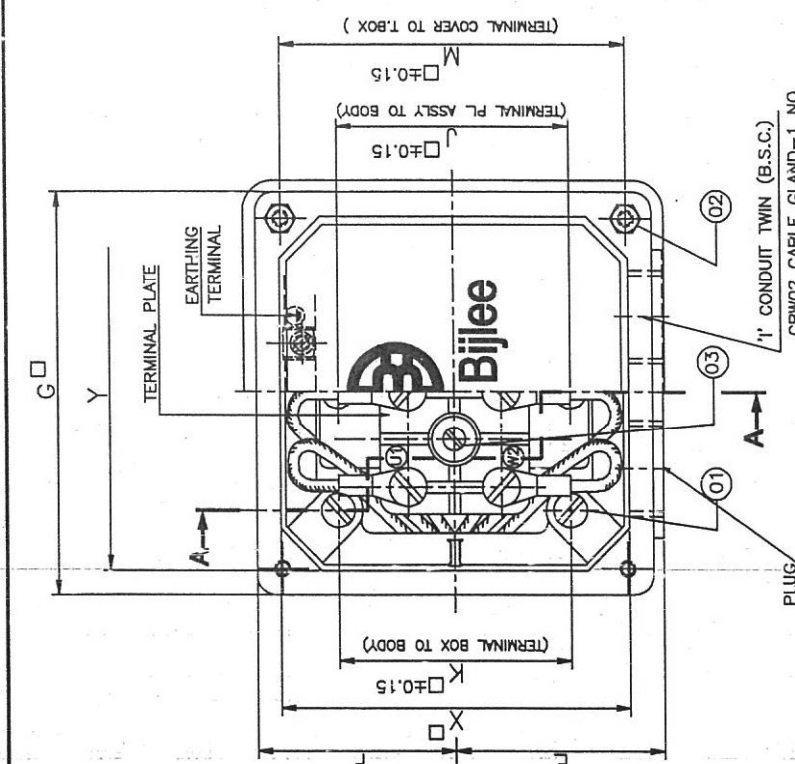


CABLE SIZE:- 1R3C6mm².
PVC INSULATED COPPER CABLE

AMEND		CONSTRUCTION		SCALE	
DATE	NAME	APPD	WO.NO.	SCALE	
URN 9.9.2010	V.S.K.	K.M.A.	G15655	N.T.S.	
CHD 9.9.2013	P.R.F.		41830-50		
BHARAT BIJLEE LTD.		E13S23013		FR-SIZE 132S	
KALWA		Ref.			

(G) AMENDED AS PER CLIENTS COMMENTS, JAG, 23.09.10

(H) AMENDED AS PER CLIENTS REQUIREMENT & Q NO. 12/10/10 P.S.T. 04.11.11



I.E.C. FRAME SIZE	EARTHING TERMINAL SCREW SIZES
132 S	M5x12 (CH HD)

T. BOX FIXING SCREWS
01 M6x15 (CH HD)
02 M5x20 (HEX)
03 M6x15 (CH HD)

SECTION A-A

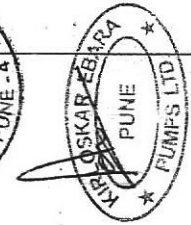
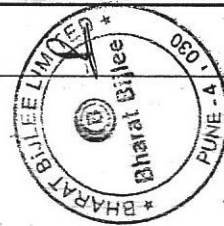
I.E.C. FRAME SIZE	TYPE OF TERMINAL BOX	DIMENSIONS												
132 S	gk 330	E	F	G	H	I	J	K	L	M	N	O	P	Q
		62.5	59	118	63	1"	70	72	M10	106	106	12	104	

⑥ CABLE SIZE: - 1Rx3Cx6mm^{sq}.
 PVC INSULATED COPPER CABLE
 TYPE REFERENCE-MN13S233
 MOTOR RATING-5.5KW-2P
 CUSTOMER NAME : KEPL
 PROJECT : BPCL
 CONSULTANT : EIL

NO. OFF	DESCRIPTION	ITEM No.	CODE No.	MATERIAL	DRG No.	PATTERN No.	WL No.
	AMENDED AS PER CLIENTS COMMENTS. JAG. 23.09.10 (5) AMENDED AS PER CLIENTS REQUIREMENT & Q No. 12/1005, P-3.1, 04.01.11						
DATE	NAME	APPRO.	TITLE	SCALE			
03/04/2011	V.S.P.	K.M.A.	TERMINAL BOX ASSEMBLY (FOR gk 330-TYPE "n")	1:1			
DRG. NO.	TBAE13SC013 @ ⑥			FR. SIZE	132 S		
REF.							

ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE SPECIFIED. ∇ FINE FINISH MACHINING (GRINDING). ∇ MEDIUM FINISH MACHINING. ∇ ROUGH MACHINING.

Code
 Date 25/6/14



KIRLOSKAR EBARA PUMPS LIMITED



Enriching Lives

Inspection Report

Date: 16.06.2011

Client: BCPL, Assam

Project: Brahmaputra Petrochemical Complex, BCPL, Lepetkata

Vender: KEPL

P.O. no. 6907-117-PA-PR-5240/215

Sub vender: M/s Bharat Bijlee Ltd. a/c Gomka Trading

BBL WO: 41830

EIL Job no. 6907

KEPL SO NO : 338

ITEM:

3.7 KW 2P Type'n' TEFC sq cage Induction motor QTY: 2 nos. (K1115295, T1103534)

5.5 KW 2P Type'n' TEFC sq cage Induction motor QTY: 3 nos. (K1105949, K1105950, K1105947)

9.3 KW 2P Type'n' TEFC sq cage Induction motor QTY: 2 nos. (K1105946, K1109044)

Machine Sr. No & Tag Nos.

K1115295 – 118-PA-600 A

T1103534 – 118-PA-600 B

K1105949 – 117-PA-472 A

K1105950 – 117-PA-472 B

K1105947 – 117-PA-482

K1105946 – 117-PA-509 A

K1109044 – 117-PA-509 B

Documents referred:

Code -1 approved datasheet

Approved GA Drawing & terminal box assembly drawing

Approved TS curves, load efficiency curves

Documents Reviewed:

1. PESO Certificate
2. ERTL test report
3. Degree of protection certificate
4. Material TC (major items)



KIRLOSKAR EBARA PUMPS LIMITED

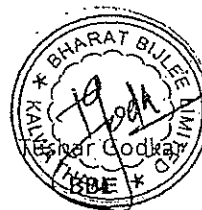
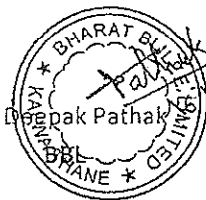
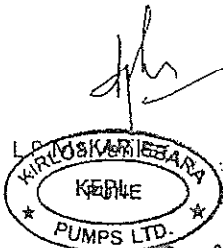
Enriching Lives

Test Witnessed:

1. Routine test
2. Type Test
3. Dimension and visual check

Observations

1. Routine test was carried out on motors bearing machine nos. K1115295, T1103534, K1105949, K1105950, K1105947, K1105946, K1109044.
2. Motor bearing machine no. T1103534 (3.7 KW), K1105947 (5.5 KW), K1109044 (9.3 KW) was selected for type test and results found satisfactory after completion of type test.
3. Dimension check was done on machine Nos: K1115295 (118-PA-600 A) , K1105950 (117-PA-472 B) & K1105946 (117-PA-509 A) which is as per approved drawing and results found satisfactory.



① Release is
 Subject to clarification / Confirmation regarding documents (drawing, data sheet) from KEP / BRL etc.
 ② Motors are technically acceptable

ENGINEERS INDIA
 SURENDRA KUMAR
 INSPECTION AUTHORITY

[Handwritten signature]

MOTOR DEPARTMENT
Type Test Report

117-PA-482

EIL Job No: 6907

KEPL Order NO: SO 338

BBL Work Order	Inspecting Authority	Client	P. O. No.
41830/50	KEPL	GOMKA TRADING / KEPL	057/2010-11

Name Plate Data

Machine No.	Type	Voltage	KW / HP	RPM	Amps.	p.f.	C/S	INS Class	Rating	Eff %
K1105947	MN13S233	415D	5.5/7.5	2920	10.10	0.88	50	F	S1	86.0
Frame : 132S, IP55, Amb. 40°C, Brg.DE / NDE: 6208ZZ C3 / 6208ZZ C3 Type of Protection Ex'n' T3										

Tag No : 117-PA-482

H. V. Test			Insulation Resistance (M-ohms)
1.6 KV	1 Min.	OK	
			>100

No Load Test :			
Volts	C/S	Amps	Watts
415	49.80	3.34	520

Reduced Voltage Test :		RPM
R. V. run up in both direction at 240 volts		
		2980

Temperature Rise Test

	Volts	Amps / 1	Amps / 2	Amps / 3	K W I/P	G1 (kg)	g (kg)	G1-g (kg)	G (kg)	RPM	C/S
Initial	415	10.09	10.32	10.07	6.431	11.70	4.30	7.40	11.55	2945	50.02
Final	415	10.06	10.32	10.10	6.481	11.70	4.30	7.40	11.55	2920	49.93

REMARKS:

Noise level in dB: DE / NDE / Amb. - 73 / 75/60

Vibration in mm / sec: Top - 0.8, Axial - 0.9, Radial - 0.9

Overspeed test: Motor runs at 20% Overspeed for 2 mins. and found satisfactory.

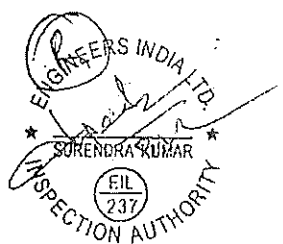
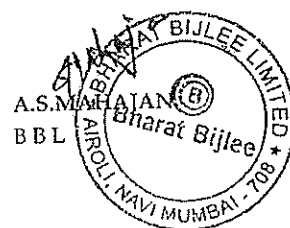
415V HEAT RUN TEST			
Time	Motor Temp. TM	Ambient Temp. TR	Temp. Rise of core (TM - TR)
11.10	Motor started		
11.15	38.00	33.00	5.00
11.45	55.50	34.50	21.00
12.15	63.50	35.00	28.50
12.45	66.00	35.50	30.50
1.15	66.50	36.00	30.50
1.45	66.50	36.00	30.50
2.15	66.50	36.00	30.50

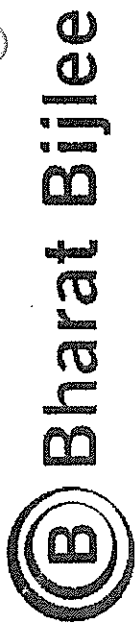
Date: 19.05.2011

Witnessed by:



Tested by:





Motor Dept. CTTF

MT1 / TT / F / 04

Induction Motor Routine Test Report

Date: 19.05.2011

Customer: KIRLOSKAR EBARA PUMPS LTD/GOMKA TRADING CENTRE

EIL Job No: 6907

P. O. No.: 57/2010-11 dated :31.08.2010

KEPL Order NO: SO 338

M/C No.	W.O. / S.O. No.	Type Ref.	KW / Pole	Frame	Const	No Load Readings			Short Circuit Readings			Resistance B/T			Amb. (°C)	I.R. Test (MΩ)	Speed	C/S			
						Amp.		Watt	Volt	Amp.	Watt	R 1	R 2	R 3							
						V0	I0 1	I0 2	I0 3	W0	Vsc	Isc	Wsc	Ω / m2							
K1105950	41830/10	MN13S233	5.5/2	132S	E3	415	3.58	3.49	3.31	662	74	10.1	588	1.455	1.452	1.462	Ω	32.5	>100	2981	49.78
Tag No: 117-PA-472B, Vibration in mm/sec: Top 1.2, Axial 0.9, Radial 1.1																					
K1105947	41830/50	MN13S233	5.5/2	132S	B3	415	3.38	3.59	3.60	666	75	10.2	604	1.456	1.453	1.456	Ω	32.5	>100	2980	49.75
Tag No: 117-PA-482, Vibration in mm/sec: Top 0.8, Axial 0.9, Radial 0.9																					
K1105949	41830	MN13S233	5.5/2	132S	B3	415	3.18	3.21	3.30	569	75	10.1	589	1.457	1.448	1.453	Ω	32.5	>100	2999	50.07
Tag No: 117-PA-472A, Vibration in mm/sec: Top 1.0, Axial 0.9, Radial 1.1																					

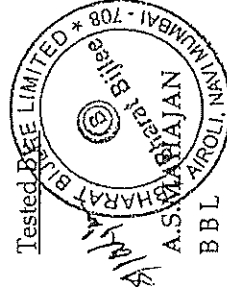
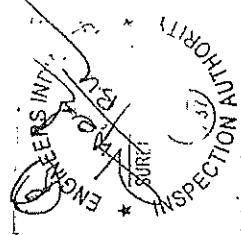
Remark: 1) Reduced voltage run-up at 240 volts: OK

2) H.V. test at 1.6 KV on winding for 1 min.: OK

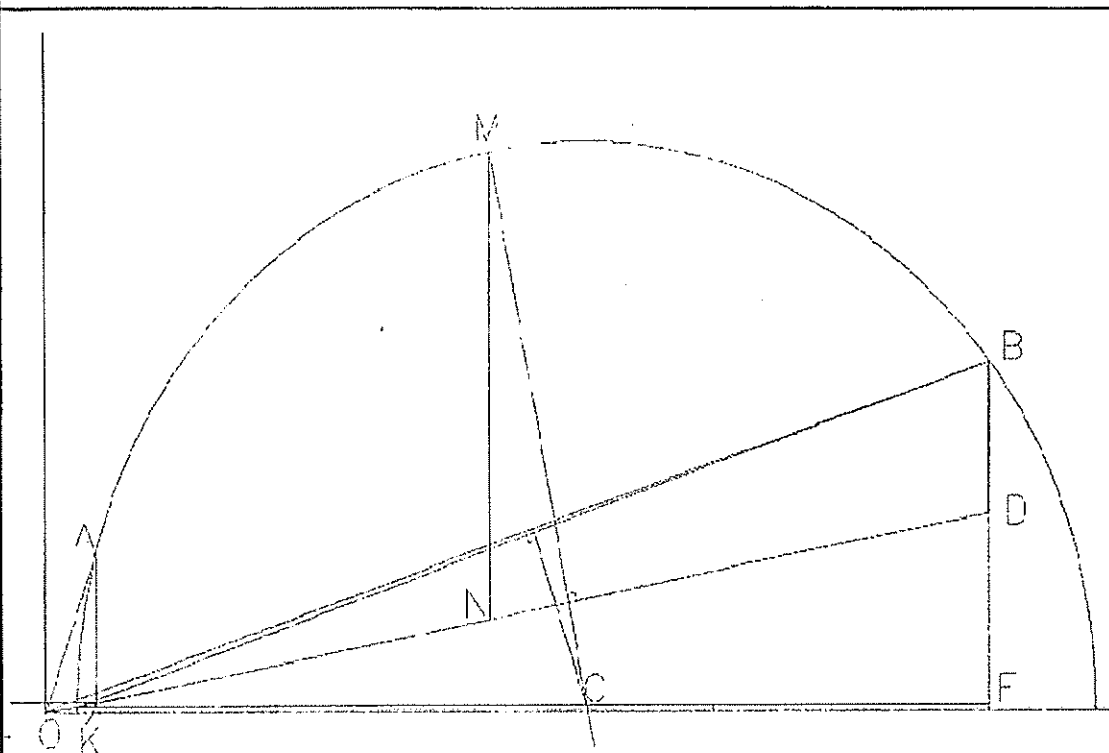
3) I. R. test before and after H. V. test: OK

4) Motor no : K1105947 selected for type test

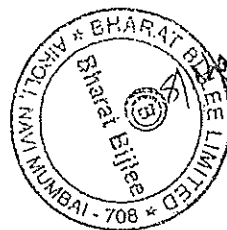
Witnessed By: 
L.P. MALVANKAR
KEPL



CUSTOMER		: M/s.GOMKA TRADING / KEPL		
WORKS ORDER NO.		: -	SAP-	41830/50
KW	: 5.5	POLE	: 2	VOLTS : 415 QTY : 1



P.O.T.	=	MIN / AK
	=	290 % FLT



2			PREP	PGP	5/19/2011
1			APPD	PGP	5/19/2011
NO	REVISION	SIGN		SIGN	DATE



GOVERNMENT OF INDIA
MINISTRY OF COMMERCE & INDUSTRY
PETROLEUM AND EXPLOSIVES SAFETY ORGANISATION (PESO)
(Formerly Department of Explosives)
CGO COMPLEX SEMINARY HILLS
NAGPUR 440006

**SPEED POST**

Letter No: A/P/HQ/MH/104/ 1868
(P234446)

Email :explosives@explosives.gov.in
Phone/Fax No.2510248/2510577

Dated : 29/7/2009

To
M/s. Bharat Bijlee Ltd.,
No.2, MIDC, Thane Belapur Road,
Airoli,
Navi Mumbai-400708
THANE (District)
Maharashtra (State)

Sub :Approval of 3PH. AC Squirrel Cage Induction Motor Frame Size 63-355L, eff1 & eff2 under
Petroleum Rules 2002.

Dear Sir(s),

Please refer to your letter No MTD/CCE/63-355L/Exn/2009 dated 03/06/2009, on the above subject.

The following Non Sparking equipment(s) manufactured by you according to IS/IEC 60079-0:2004 & IS/IEC 60079-15-2005 standards is approved for use in Zone 2 of Gas , Group II hazardous areas coming under the purview of the Petroleum Rules, 2002 administered by this Organization.

Sr.No	Description	Safety Protection	CCEs Identification Number	Test House	Test Report No.	Drawing Numbers
1	3Phase AC, Squirrel cage Induction Motor, Frame Size 63-355L, eff1 & eff2	Ex 'n' II T3	P234446/1	ERTL (E), Kolkata	ERTL(E)/TES/B178/0008/12-08 Dt.26/5/2009	As per Test Report

This Approval is granted subject to observance of the following conditions:-

- 1). The design and construction of the equipment shall be strictly in accordance with description, condition and drawings as mentioned in the ERTL Test Reports referred to above.
- 2). The equipment shall be used only with approved type of accessories and associated

<http://10.0.1.11/explosives/P/NewFLP/scri/rtepreview.asp>

7/30/2009

- apparatus.
- 3). Each equipment shall be marked either by raised lettering cast integrally or by plate attached to the main structure to indicate conspicuously:-
- (a) Name of the manufacturer
 - (b) Name and number by which the equipment is identified.
 - (c) Number & date of the test report of the ERTL applicable to the equipment.
 - (d) CCEs Identification Number of this letter by which use of apparatus is approved.
- 4). A certificate to the effect that the equipment has been manufactured strictly in accordance with the drawing referred to in the ERTL Test report and is identical with the one tested and certified at ERTL, Kolkata shall be furnished with each equipment.
- 5). The customer shall be supplied with a copy of this letter, an extract of the conditions and maintenance schedule, if any, recommended by ERTL in their test reports and copy of instructions booklet detailing operation & maintenance of the equipment so as to maintain its Non Sparking characteristics.

This approval also covers the permissible variations as approved under the ERTL test reports referred to above. This approval may be deemed to have been revoked with immediate effect at any time, if any of the conditions subject to which approval has been granted is violated or not complied with. The approval may also be amended or withdrawn at any time, if considered necessary in the interest of safety.

The field performance report from actual users/your customers of the subject equipment may please be collected and furnished to this office for verification and record at regular intervals.

The Approval otherwise is valid for a period of five years from the date of issue

In supersession of earlier approval letter No. A/P/HQ/MH/104/1333(P193577) dated 13/03/2007 and A/P/HQ/MH/104/1487(P209189) dated 19/02/2008. except for *growing demand* Type 'e' Increased safety motors.

Yours faithfully,

growing demand
(P C Srivastava)

Deputy Chief Controller of Explosives
for Chief Controller of Explosives
Nagpur

Copy to :

The Jt. Chief Controller of Explosives, West Circle, Mumbai; East Circle, Kolkata; South Circle, Chennai; North Circle, Faridabad; Central Circle, Agra.

for Chief Controller of Explosives

1. Installation & Maintenance of Motors

1. Receiving and storing of motors :

- ❖ Make sure that the right type of motor as ordered by you has arrived and it is not damaged in transit. In case of any such problem report immediately to our office.
- ❖ Store the motor in a clean dry place if it is not to be installed immediately.

2. Installation and mounting of motors :

Before installation and mounting observe the following.

- ❖ See that the motor rotates freely by turning the shaft by hand.
- ❖ Replace the grease charge of bearings if the motor has been stored for longer than 18 months.
- ❖ Check the insulation resistance by applying a D. C. voltage of 500 V. If it is low due to moisture, dry out the stator winding till the insulation resistance increases above one megaohm by any of the accepted methods. (Ref. IS 900- 1992)
- ❖ Remove anticorrosion coating on the shaft with petrol, white spirit or kerosene. Do not scrape the coating.
- ❖ See that the machined surface of motor feet (or flange face) and also the surface on which the motor is mounted is clean and perfectly in level.
- ❖ The coupling parts to be fitted on the motor shaft are to be properly balanced. The bore and key way are to be machined accurately. The recommended tolerance for the bore diameter is H7.
- ❖ The coupling parts or pulley must be carefully fitted by means of special tackle for which a tapped hole is provided at shaft end. Hammering must be avoided since it might damage bearings. The tackle can also be used for removal of coupling (See Fig.1)
- ❖ While using Non-flexible coupling it should be noted the shafts of the motor and the driven machine must be in perfect alignment and axes should coincide. Inaccurate alignment results in stresses on bearings and noisy running.
- ❖ See that screws for fixing the motor (or flange) to the foundation, are secured properly.
- ❖ Install the motor such that the cooling air has free access and can pass unobstructed over the motor.

3. Electrical Connections :

While doing electrical connection ensure following points:

- ❖ Use appropriate size of cable for connecting the motor.
- ❖ The supply voltage should be same as given in the rating plate. Unless otherwise specified the tolerances is 10% of the rated voltage.
- ❖ Connect the motor in accordance with the connection (Star or Delta) given in the rated plate and connection diagram given inside the Terminal box cover.
- ❖ **Connect earth terminal effectively for protection. This is very important to ensure safety. Local electrical code must be followed.**
- ❖ Normally 3 phase motors upto 2 HP have their winding connected in Star (Y). These motors have three terminals and are meant for direct on line starting only.
- ❖ Motors above 2 HP have windings suitable for delta (D) connection. These motors can be started with a Y-D starter or Direct on Line starter using connecting links as shown in the connection diagram.
- ❖ While connecting the cables to motor terminals please ensure that the cable is properly secured and clamped and it does not exert any tension on terminal. A heavy load or tension by the cable can break the terminals.
- ❖ **Motors must be installed as per the local electrical code/regulation by an authorised person. Motors must be protected against overload and short circuit conditions.**

4. Maintenance :

During maintenance please note the following points :

- ❖ The bearings are prelubricated and maintenance free. Operating conditions permitting, unsealed bearings should be cleaned at intervals of about 10000 operating hours, with trichloroethylene or clean petrol. While lubricating please see that the bearings are well lubricated and

about one third of the space within bearing covers is filled with grease. Over filling of grease is not recommended.

While regreasing motors provided with regreasing arrangement, keep the grease outlet open and fill grease when the motor is running so that old grease/excess grease will flow out.

- ❖ Balmer Lawrie LL3 and Shell-MP 3 are recommended for use in motors. Mixing of grease should be avoided.
- ❖ When the motor is opened, protect bearings from foreign particles and dirt by wrapping them with clean paper or polythene sheet.
- ❖ During reassembly of motor ensure that wavy washer and brass washers are kept in their position and bearing covers are secured properly. These washers are specially designed to provide adequate preloading on the bearings.
- ❖ Clean the entire path of the cooling air on the motor at regular intervals.
- ❖ The temperature of the motor, judged by hand feeling, could be misleading. In the case of suspected overheating the actual temperature should be measured with thermometer and should be compared with the permissible temperature rise according to the temperature class of the motor.
- ❖ Overheating of the motor may be due to over loading of motor, too low or too high supply voltages, frequency fluctuations, over greasing of bearings, foreign material in the air gap between stator and rotor. Necessary corrective action is to be taken accordingly.
- ❖ When ordering spare parts state the motor type, machine number, type of construction as shown in the rating plate, part description given in the part list and number of units required.

5. Special installation instructions for IP55/IP56 construction motors :

- ❖ Conduit entries are fitted with threaded plugs and are sealed. Open the plug and clean threads before fitting cable gland. Use double compression gland and seal the threads of glands with sealing cement. This will ensure IP55/IP56 Protection of the cable entry.
- ❖ After the cable connection fix the T. Box properly. Ensure that the rubber gasket provided is not dislocated or distorted and fixing screws are fully tightened.
- ❖ Wherever possible it is recommended to cover the motor from direct heating by the sun. Provide a canopy over the motor.
- ❖ The motor shaft is provided with oil seals/ 'v' rings on both ends. Drain plugs are provided on front and back sides.(ref. fig 2.) During periodic inspection say once in 3 months open the drain plugs and drain out condensed water if any.
- ❖ While replacing oil seals make sure that oil seals are not distorted, the springs are in their position and the lip of the oil seal is free. Apply small amount of grease to the lip. 'V' rings can be replaced by first removing the M.S. cap. the new 'v' ring is to be fitted such that the lip just rests against the end shield face. (Excessive pressure will lead to premature failure of the 'v' ring). Replace the M.S.cap.
- ❖ Whenever, the motor is opened and reassembled ensure that all joints faces are properly cleaned and gasket cement is applied properly at all joints.(ref. fig 2.)
- ❖ Recommended gasket cements : Anabond 681 of Anabond Ltd.

2: SPECIAL INSTRUCTIONS FOR INSTALLATION AND MAINTENANCE OF FLAME-PROOF MOTORS :

A sealing end box is mandatory for all motors for use for Gas Gr. I and Oil Mines.

A DGMS identification mark must be fitted on the motor for use for Gas Gr. I or Oil Mines. In case the DGMS mark is not provided please obtain the same from BBL.

- ❖ Flame-proof motor is designed and manufactured in accordance with the requirements of IS 2148-1981. The construction is approved by C.M. R.I. No modification or alteration to be approved construction of the motor is permitted. For replacement of parts, please consult Bharat Bijlee.
- ❖ Each motor must be protected by a motor protections circuit breaker or any other protective device approved by the concerned authorities.
- ❖ The cable entry can be made from any one of four directions by turning the terminal box in steps of 90° C. Do not turn the bottom piece. Lead wires will be damaged if bottom piece is turned.
- ❖ Conduits and type of cable (e.g. PVC, PILCDWA, ect.) should strictly correspond to the conduit tapping or cable entry provided on the terminal box.
- ❖ For PVC cables when sealing box is not provided, use FLP cable glands. Statutory approval is a must for FLP glands.
- ❖ For PVC cables, when sealing box is provided use of SIBG glands is permitted.
- ❖ For PILCDWA cables (used in mines), the cable entry consists of sealing box, adaptor plate, cable gland with lead bush and a cable clamp. When assembled make sure that the cable is held firmly in the gland.
- ❖ Before supply cable connection, Sealing box (where ever used) should be properly filled with solid setting bituminous compound specified for electrical purpose. Compound Retaining Barrier is provided in between the Terminal Box and Sealing Box. Drill required size of holes on it and replace/fix carefully such that supply cables can pass through for making terminal connections before compound filling.
- ❖ Strip off the insulation properly from the cable ends. The position where the cable insulation is cut should be carefully taped before making the connections.
- ❖ Connections of supply leads to the motor terminals should be made as shown in the connection diagram. The clearances and creepage distance inside the terminal box must be maintained to the maximum.
- ❖ During assembly of terminal box parts and subsequent routine maintenance, please observe the following points.
- ❖ The machined joint faces shall not be refinished, tampered, damaged or coated with varnish or paint.
- ❖ On all motor a thin coat of Grease should be applied on all motors joints. (Grease Balmer Lawrie LL3 should be used)
- ❖ Replace defective/broken screws by new screws of the original material and tensile strength as per grade 8.8.
- ❖ All screws, bolts, nuts etc. used for fixing the parts of flame-proof enclosure are to be provided with spring washers to prevent them from getting loose due to shocks and vibrations, during operation.
- ❖ All gaps between mating parts of joints forming flame-proof enclosure are to be thoroughly checked with feeler gauge to ensure that gap clearances are within 0.1mm.

D Dismantling and reassembling.

Follow the sequence given below :

- ❖ Remove the fan cowl and fan, unscrew fixing screws of back endshield and pull out the back endshield with the rotor in the case of MJ80 to MJ130. In other motors unscrew the front B.B.C.(where ever provided) fixing screws also before pulling out the back endshield with the rotor. Pull out front endshield after unscrewing the fixing screws.

- ❖ Press out the back endshield in the case of MJ80 to MJ130 after removing the circlip on the inside of endshield bearing housing.. In other frame sizes back endshield can be removed from rotor after removing back outer B.B.cover.
- ❖ Dismantling of the motor should be done carefully without damaging any of the joint faces components rotor, stator and windings. If any damage is noticed after dismantling, such component should be replaced by the new component. Rectification of damage by metal filling or adhesive filling is not permitted.
- ❖ Assembly of the motor is to be done in reverse order of dismantling .
- ❖ During rewinding take precautions given below.
- ❖ Burning of old winding to remove coils from slot should not be done.
- ❖ Cut overhang portion of winding with chisel.
- ❖ Heat the body at 130°-140° C in the oven for 2 hrs.
- ❖ With the help of copper rod and hammer, force out copper wire from the slots and clean slots by filing.
- ❖ Stator body should be handled carefully to avoid damage on machined portion of the body. Any damage, burr will result in change of flame path gap.
- ❖ Reassembled motor carefully as explained above.

N.B.:

- 1) Burning of winding with flame will distort the body. After reassembly flame path gap may increase.
- 2) Carefull handling and correct reassembly shall ensure flame-proofness of the enclosure.
- 3) It is advisable to give rewinding work to an authorised rewinder of BBL.

3: SPECIAL INSTRUCTIONS FOR INSTALLATION AND MAINTENANCE OF BRAKE MOTORS :

► **IMPORTANT :**

Before giving supply to the motor ensure that the brake is releasing. Apply the specified voltage at the brake terminals, and check that the motor rotates freely by turning the shaft by hand.

In case the brake is not releasing, adjust the air-gap between the magnet assembly and the armature disk assembly to 0.3 mm as described below.

► **ADJUSTMENT OF AIRGAP/ COMPENSATION FOR LINER WEAR :**

The wear of the brake liner depends on the frequency of operation or number of starts/stops of the motor and the load GD2 or inertia of the load .

It is recommended that the airgap (ref. fig.5 & 6) should generally be done when the liner is worn out through 1 mm. thickness (i.e. total air gap is 1.3 mm)

► **METHOD :**

Remove the fan cowl.

In case of motors in frame size 71 & 80 remove the split pin (400) from the castlenut(ref.fig. 5).

❖ In case of motors in frame size 90 to 132, remove the screws (402) from the locknut (ref. fig. 2).

❖ Now rotate the castlenut/locknut till the air gap is 0.3 mm. Use filler-gauge to ensure proper air gap.

❖ Insert the split pin or fix the screws in the castlenut/locknut as the case may be.

❖ Replace the rubber cover in its place and fix the fan cowl.
The brake is now adjusted and ready for operation.

It is recommended that the entire armature disk assembly is replaced when the liner has worn by 3 to 4 mm. (i.e. after 3 or 4 adjustments).

► **Adjusting the braking torque :**

The braking torque is proportional to the number of compression springs. The standard torque values for different frame sizes are given below :

Frame sizes	Std.Braking torque (Kgm)
71	0.5
80	1.0
90S, 90L	2.0
100L	4.0
112M	5.0
132S, 132M	5.0

It can be increased by upto 40% (max). by inserting washers under all the compression springs, after removing the castle nut/lock nut and fan.

It can also be reduced by upto 50% (max). by removing some of the compression springs. Not more than half of them should be removed. the remaining springs must be distributed uniformly around the circumference of the magnet yoke.

The brake should be then reassembled.

► **SPARES :**

The list of spares which can be provided is given in fig. 5 and 6.
A manual release kit is available for incorporating manual release arrangement for motors in 90S onwards.

N.B:

1.0 Brake unit with Manual Release arrangement cannot be replaced in old design for 132S/132M Frame Brake motors.

2.0 Brake unit with manual release arrangement can be replaced in old design of 90S/90L, 100L & 112M Frame.

4: SPECIAL INSTRUCTIONS FOR INSTALLATION AND MAINTENANCE OF SLIP RING MOTORS.

► **TERMINAL BOX:**

The terminal box is arranged on top of the frame. It contains 6 terminals (3 for stator, 3 for rotor). The terminal box conforms to degree of protection IP55.

The terminal box is provided with two twin-cable entries. One twin entry is on Righthand side and the other on the Left-hand side as viewed from the driving shaft end.

Two earthing terminals are provided in the terminal box and one on the mounting foot.

Cable entry size is 3/4" B.S. conduit entry. Maximum cable OD suitable for these entries is 19mm Dia.

► **SLIP RINGS, BRUSH-BLOCK ASSEMBLY:**

The Slip-rings are arranged at the drive end. These are easily accessible by removing the top T.Box cover.

The brush holders are assembled as a complete unit called brush-block assembly. It can be easily replaced as a whole without dismantling the motor.

► **BEARING:**

Pre-published Sealed for Life Deep-Groove ball bearings are used on the motors.

► **STARTING:**

The starting torque is increased by introducing external resistance in the rotor circuit. The maximum starting torque that can be achieved is equal to the Break-down(Pull-out) torque.

The starting resistance (including rotor resistance) $R + r$ (In ohms) is calculated from the equation-

$$R+r = \frac{U}{I_n \times \sqrt{3}} \times \frac{M_n}{M_s}$$

Where, R = external resistance per phase

r = rotor resistance per phase

I_n = rotor rated current

U = rotor Voltage

M_n = rated torque, 'kg-m'

M_s = required starting torque, 'kg-m'

In most cases, the rotor resistance is neglected and $R+r$ is assumed equal to the external starting resistance. Should it be necessary to allow rotor resistance, it can be determined with sufficient accuracy from the following equation-

$$r = \frac{U}{I_n \times \sqrt{3}} \times \frac{N_s - n}{N_s}$$

Where N_s = Synchronous speed

n = Rated speed

As the speed picks up, the starter cuts-out the external resistance in steps. The various values for $R+r$ are calculated by assigning different values to M_s while using the equation.

► **SPARES :**

The following items are available as spares (in addition to items shown in fig. 3.)

1. Brush holder
2. Slip Ring
3. Carbon Brushes

5 : Fault Analysis

TROUBLE	CAUSE	REMEDY
1) Abnormal noise (a) Continuous	i) Fan rubbing against end shield ii) Fan rubbing against cowl, dented iii) Bearing failure iv) oil seal rubbing v) Rotor-Stator rubbing vi) Excess preloading of bearing	i) Rectify the defect ii) Replace cowl/rectify iii) Replace bearing iv) Apply few drops of oil to lip v) Rectify the defect vi) Reduce preloading
(b) Intermittent	i) Dirt in bearing greases	i) Clean & regrease bearings (ref: 6-II)
2) Magnetic noise	i) air gap not uniform ii) Rotor unbalance	i) check & correct endshield fit/bearing ii) Re-balance rotor
3) No Load current is high	i) Wrong external connections ii) Voltage high iii) Frequency low iv) Faulty installation v) Inherent design feature vi) Stator - rotor misalignment	i) Verify & correct ii) - iii) - iv) Correct v) * vi) Verify & correct
* Note : a) In case of small hp, special motors, Crane duty motors, the no Load current could be as high as Full Load current. b) No Load current specified in Test Certificate is at rated voltage i.e. generally 415 V 50 Hz. If No load current is high check for Voltage & Freq. variation.		
4) Full Load current is high	i) Voltage high/low ii) Motor selection is wrong iii) Overloading iv) Blowers/pumps operating out of specified range	i) Regulate supply ii) Select correct motor iii) Take coorrective action iv) Operate in specified range
5) No load Current unbalance	i) Wrong external Correction ii) Voltage unbalance iii) Stator winding resistance unbalance	i) Verify & Correct ii) Check for faulty leads connections and transformer iii) Rewind
Note : There could be current unbalance of 5% (15% for 2 pole) on No load running even with balanced volatge supply. The unbalance in current reduces when the motor is loaded. 1% unbalance in voltage can cause 6 to 10% u.balance in current		

TROUBLE	CAUSE	REMEDY
6) Hot bearings, ball or roller	i) Insufficient grease ii) Deterioration or contamination of grease iii) Excess grease iv) Overloaded bearings v) Broken ball/rough races	i) Maintain proper grease quantity. ii) Remove old grease, wash bearing thoroughly in petrol to which a few drops of oil have been added & replace with new grease. iii) Reduce grease quantity iv) Take corrective action v) Replace bearing & clean housing.
7) Shaft temp. is high	i) Defective bearing ii) Oil sealing rubbing against shaft (in motors with oil seal)	i) Replace bearing ii) 45°C-50°C rise above ambient is OK. If more replace oil seal or put drop of oil on the lip.
8) Motor body temp is high (Check at eyebolt hole with thermometer)	i) Rotor - stator rubbing ii) Wrong motor selection iii) Overloading iv) Ambient temp. is high v) Inherent design feature (B/F class) vi) Fan cooling is affected vii) High no. of start/stops viii) Motor dirty ix) Single phasing x) Voltage unbalanced	i) Rectify ii) Select correct motor iii) Reduce load/change motor design. iv) Select right motor v) No action required if temp. rise is within limits vi) Rectify vii) Verify the motor selection viii) Clean periodically ix) Check lead connections x) Check for faulty leads connections and transformers
9) Speed is low	i) Frequency low ii) Defective rotor iii) Overloading	i) - ii) Replace motor iii) Take corrective action
10) Wrong direction rotation.	i) Wrong sequence of phases	i) Interchange any 2 phases
11) Motor runs and then stops	i) Power failure/Single phasing ii) Overload	i) Check for loose connections ii) Examine over load relay trip setting
12) Motor connected but does not start	i) No supply voltage, one phase open or voltage too low ii) Starting torque of load too high iii) Control gear defective	i) Check voltage on each phase. ii) Reduce load or study requirement. If sq. cage motor with auto-transformer starting, change to a higher tap. If slipping, lower starting resistances. iii) Rectify (Check contacts)

TROUBLE	CAUSE	REMEDY
13) Motors do not take load	i) Defective motor ii) Wrong motor selection iii) Voltage low	i) Replace motor ii) Change the motor iii) -
14) (a) Water/oil/ Dirt entry (b) Oil leakage from gear box	i) Oil seal defective ii) Improper mounting of oil seal iii) Poor joint sealing i) Flange fixing holes are not tightened/ sealed.	i) Replace oil seal ii) Replace oil seal iii) Rectify i) Rectify
15) Vibration	i) Defective bearings ii) Rotor-rubbing iii) Motor misalignment iv) Loose fixing bolt v) Poor balancing of drive equipment vi) Coupling out of balance vii) Balancing weights detached viii) Wound rotor coils replaced ix) Weak foundation x) Single phasing xi) Excessive end play add washer	i) Replace bearings ii) Rectify iii) Re-alignment iv) Rectify v) Rebalance vi) Balance coupling vii) Rebalance rotor viii) Rebalance rotor ix) Strengthen base x) Check for single phasing xi) Replace bearing or add washer under D.E. bearing
16) Motor fails or burns	i) Defective bearings ii) Voltage unbalance overheating iii) Loss of insulation of stators wdgs. iv) Overloading v) Ambient temp. is high vi) Winding failure (Inter-turn short, failure of lead wire, insulation paper, etc)	i) Replace bearing ii) - iii) Rewind-provide space heater if humidity is high. iv) Take corrective action v) Rewind with higher insulation class vi) Rewind.
17) Bearing failure	i) Defective bearings ii) Overloading (in the case of belt drive, use roller bearing) iii) Poor alignment iv) Poor/No lubrication v) Dried out greases	i) Replace bearing ii) Take corrective action iii) Correct misalignment iv) Lubricate v) Regrease
18) Rusting of shaft/ flange	i) Poor application of rust preventive ii) Long/wrong storage of Motor	i) Clean shaft/flange ii) Clean shaft/flange

TROUBLE	CAUSE	REMEDY
19) Axial Play	i) Bearing preloading washer misplaced ii) Wrong application of motor iii) NDE End Shield bearing housing damaged.	i) Replace preloading washer ii) Select the correct motor iii) Replace End Shield
20) Overload relay tripping due to excess current	i) Overloading ii) Starting time is high iii) Defective rotor iv) Wrong selection of motor v) High voltage variation vi) Low Frequency vii) Wrong relay setting (Due to variation in voltage & frequency the current drawn will be higher. If relay setting is on full load current as per name plate relay may trip.)	i) Take corrective action ii) Take corrective action iii) Replace motor iv) Change the motor v) Contact the manufacturer vi) Reduce loading if possible vii) Set relay at 1.15 times full load current
21) Thermal relay	i) Design of motor not matching application ii) Wrong selection of thermistor for the application/motor	i) Contact manufacturer ii) Replace with correct thermistor
22) Seizing of shaft on FLP motor	i) Excessive belt load ii) Bearing failure iii) Inner BBC loosely fitted	i) Reduce belt load ii) Re-assemble after rectifying damage iii) Fixing screws of Bearing covers should be tightened properly during reassembly
23) Low Insulation	i) Motor subject to water, rains, floods.	i) Dismantle and clean parts. Then bake windings in oven at 90°C for 24 hours or until resistance to ground is sufficient (> 1 megaohm)
Note: 1) Also refer IS 900 - 1992. 2) In case of difficulty in locating the cause for a problem please contact nearest branch office of Bharat Bijlee Ltd.		

6. RECOMMENDED MAINTENANCE SCHEDULE :

► **Daily Maintenance :**

- ❖ Examine visually earth connections and motor leads.
- ❖ Check motor windings for overheating.
- ❖ Examine control equipments.

► **Weekly Maintenance :**

- ❖ Check belt tension. In cases where this is excessive, it should immediately be reduced .
- ❖ Blow out the motor surface of protected type motors situated in dusty locations.
- ❖ Examine starting equipment for burnt contacts where motor is started and stopped frequently.

► **Monthly Maintenance**

- ❖ Overhaul controllers.
- ❖ Inspect and clean oil circuit breakers.
- ❖ Wipe brush holders and check bedding of brushes of slip- ring motors.

Half Yearly Maintenance :

- ❖ Clean windings of motors subjected to corrosive or other elements; also varnish and bake, if necessary.
- ❖ In case of slip-ring motors, check slip-ring for grooving or unusual wear.
- ❖ Check grease in ball and roller bearings and make it up where necessary, taking care to avoid over-filling.

Note : 1) Where regreasing provision is given, regreasing should be done while the motor is running. Keep the grease outlet open.

2) The grease used by Bharat Bijlee is Balmer Lawrie LL3. Mixing of grease of other make/type should be avoided.

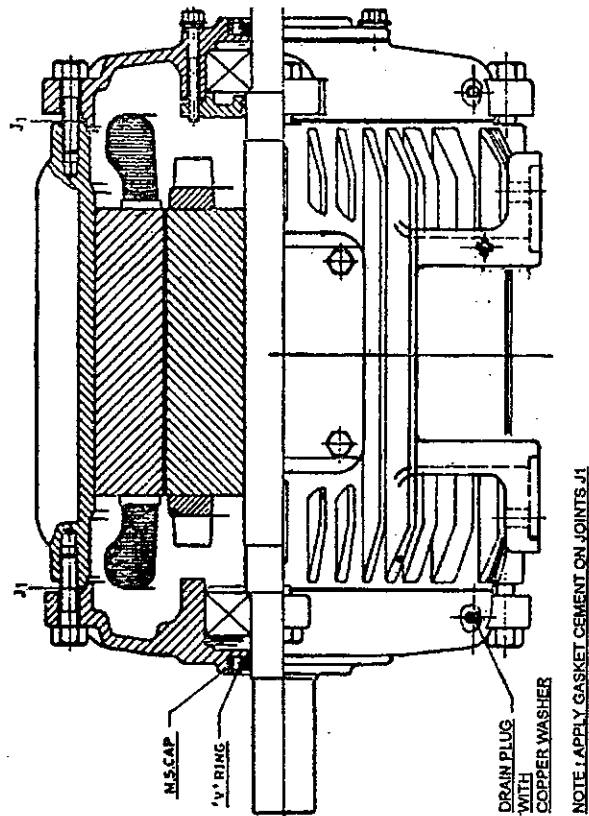
► **Annual Maintenance :**

- ❖ Check all high speed bearings and renew, if necessary.
- ❖ Blow out all motor surface thoroughly with clean dry air. Make sure that the pressure is not so high as to damage the insulation.
- ❖ Clean and varnish dirty and oily windings.
- ❖ Overhaul motors which have been subjected to severe operating conditions.
- ❖ Renew switch and fuse contacts, if damaged.
- ❖ Renew oil in starters subjected to damp/corrosive elements.
- ❖ Check insulation resistance to earth and between phases of motor windings, control gear and wiring.
- ❖ Check resistance of earth connections.
- ❖ Test the motor overload relays and breakers.

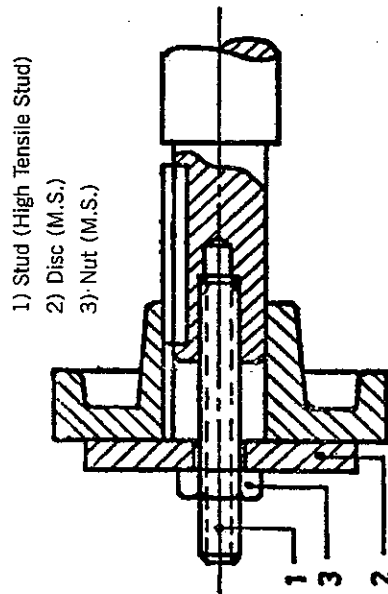
► **Records :**

- ❖ Maintain a register giving one or more pages for each motor and record therein all important inspection and maintenance works carried out from time to time. These records should show past performance, normal insulation level, air gap measurements, nature of repairs and time between previous repairs and other important information which would be of help for good performance and maintenance.

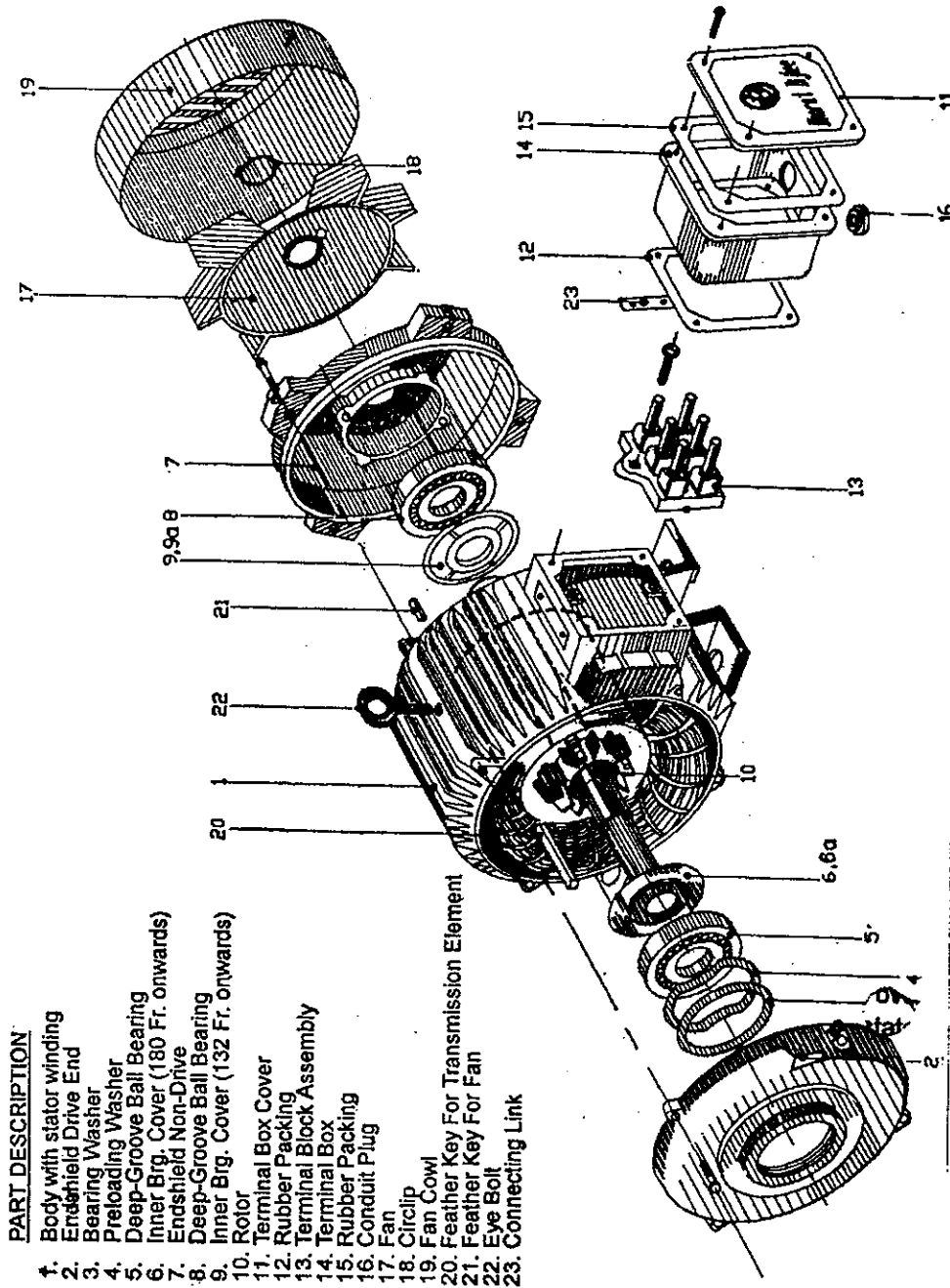
(FIG. 2)



(FIG. 1)



STANDARD MOTOR SPARE PARTS IDENTIFICATION (FIG. 3)



PART DESCRIPTION

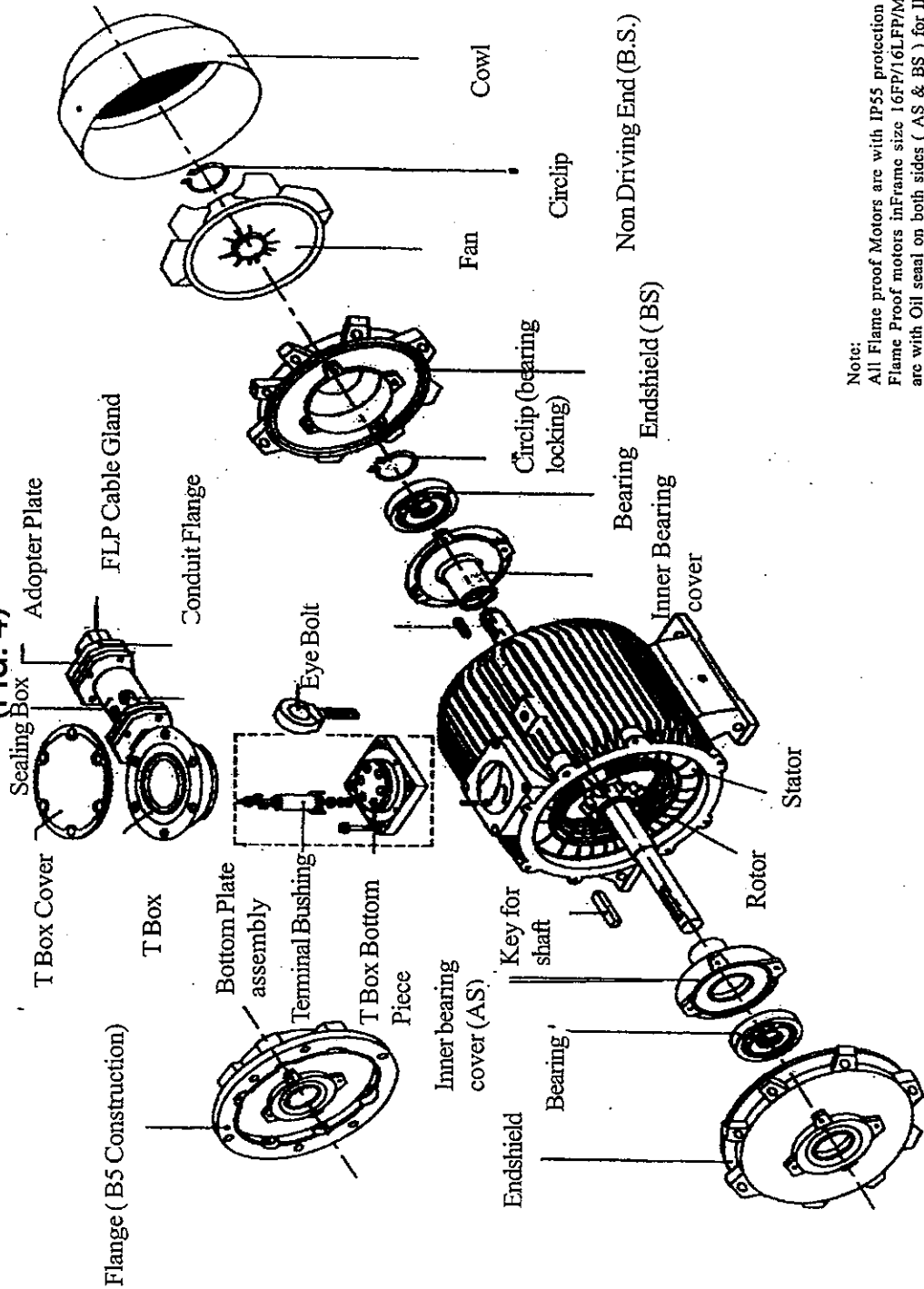
1. Body with stator winding
2. Endshield Drive End
3. Bearing Washer
4. Preloading Washer
5. Deep-Groove Ball Bearing
6. Inner Brg. Cover (180 Fr. onwards)
7. Endshield Non-Drive
8. Deep-Groove Ball Bearing
9. Inner Brg. Cover (132 Fr. onwards)
10. Rotor
11. Terminal Box Cover
12. Rubber Packing
13. Terminal Block Assembly
14. Terminal Box
15. Rubber Packing
16. Conduit Plug
17. Fan
18. Fan Cowl
19. Feather Key For Transmission Element
20. Feather Key For Fan
21. Eye Bolt
22. Connecting Link

Note :

In Aluminium Pr. die cast body tie rods are
In place of Hexhead Bolt for endshields fixing.

FLAME PROOF MOTORS SPARE PARTS IDENTIFICATION

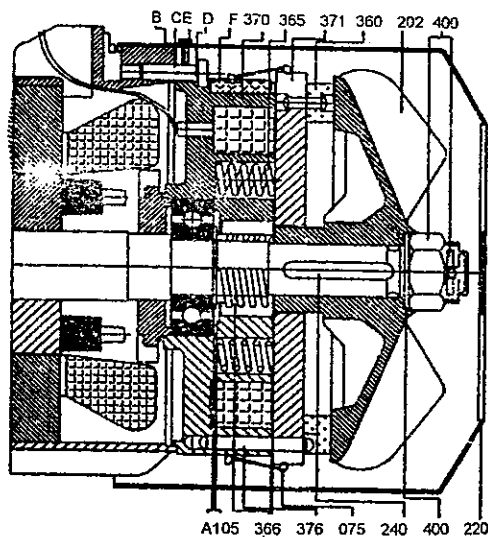
(FIG: 4)



Note:
All Flame proof Motors are with IP55 protection
Flame Proof motors in Frame size 16FP/16LFP/MJ180/20LFP/60FP/MJ280 are with Oil seal on both sides (AS & BS) for IP55 protection.

Flame proof motors MJ80, MJ90, MJ130, MJ160, MJ200, MJ225, and MJ250 are provided with Rubber seal ' V ring ' and M.S. Cap on both sides (AS & BS) for IP55 protection.

Flame proof motors with B5 construction are provided with Oil seal on Driving side (AS) for O.T.S.



- 1) WORKING AIR GAP 0.1-0.4 MM. TO BE ADJUSTED WITH THREADED LOCK NUT
- 2) BRAKE LINER SURFACE OF ARMATURE AND BRAKE SURFACE OF FAN SHOULD BE CLEAN
- 3) FAN BORE, SHAFT AND THREAD SURFACE ARE TO BE TREATED WITH RUST PREVENTIVE

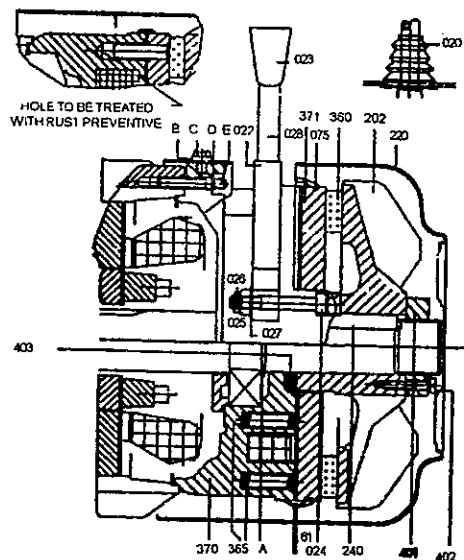
MANUAL RELEASE SPARES

- 075) COVER SLEEVE FOR MAGNET
- 105) BUSH M.S.
- 202) FAN C.I.
- 220) FAN COWL
- 240) FEATHER KEY FOR FAN
- 360) BRAKE LINER
- 365) SPRING FOR FAN
- 370) MAGNET ASSEMBLY
- 371) ARMATURE DISC ASSEMBLY
- 376) GUIDE PIN
- 400) CASTLE NUT, WASHER AND SPLIT PIN

THE ABOVE ITEMS ARE AVAILABLE AS SPARES

- A) CIRCLIP (EXTERNAL)
- B) SPRING WASHER
- C) HEX. HEAD SCREW
- D) SPRING WASHER
- E) CHEESE HEAD SCREW
- F) PACKING

FIG. 5
FRAMES 71 & 80



- 075) COVER SLEEVE FOR MAGNET
- 105) BUSH M.S.
- 202) FAN C.I.
- 220) FAN COWL
- 240) FEATHER KEY FOR FAN
- 360) BRAKE LINER
- 365) SPRING FOR BRAKING
- 366) SPRING FOR FAN
- 370) MAGNET ASSEMBLY
- 371) ARMATURE DISC ASSEMBLY
- 376) GUIDE PIN
- 400) CASTLE NUT, WASHER AND SPLIT PIN
- 401) LOCK NUT, WASHER
- 402) LOCK NUT FIXING SCREW
- 403) V.RING

MANUAL RELEASE SPARES

- 020) RUBBER BELLOWS
- 022) BRACKET
- 023) KNOB
- 024) BRACKET SCREW
- 025) SLOTTED NUT
- 026) SPLIT PIN
- 027) PLAIN WASHER
- 028) M.S. ROD

THE ABOVE ITEMS ARE AVAILABLE AS SPARES

- A) CIRCLIP (EXTERNAL)
- B) SPRING WASHER
- C) HEX. HEAD SCREW
- D) SPRING WASHER
- E) CHEESE HEAD SCREW

FIG. 6
FRAMES 90 TO 132

B Bharat Bijlee Limited

: Registered Office :

Electric Mansion, 6th Floor, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025.
Tel.: 2430 6237, 2430 6375 Fax: 022-2437 0624

: Central Marketing Office & Works :

Post Box No. 100, Thane Belapur Road, Thane 400 601.
Tel : 2760 0401 / 2760 0411 Fax : 91-22-2760 0430

Offices

REGION	CITY	ADDRESS	PHONE	FAX
NORTH	NEW DELHI	Milap Niketan, 4th Floor, 8A, Bahadur Shah Zafar Marg, New Delhi 110 002	2371 14 34 2331 96 94/95/96	011-2331 9413
	LUDHIANA	7, Ghan Market, Opp. Ramgarhia Gurudwara, G. T. Road, Miller Ganj, Ludhiana - 141 003	2531 663 2542 131	0161-2533826
	INDORE	C/o. Tirupati Engineering, 128, 3rd Floor, Dawa Bazar, RNT Marg, Indore 452 001	2704 474 2704 486	0731-2704390
EAST	KOLKATA	Flat No.8, 'Mansarowar', 2nd Floor, 3B Camac Street, Kolkata 700 016	2217 23 82 2217 23 83/ 84	033-2217 2467
WEST	MUMBAI	Post Box No.100, Thane Belapur Road, Thane 400 601	2760 58 34 2760 58 35 / 36	022-2760 0430
	PUNE	9, Ketki Building, 2nd Floor, Next to Alka Theatre, Sadashiv Peth, Pune 411 630	433 48 31 432 12 67	020-433 9210
	AHMEDABAD	202, Arth, 8-Rashmi Society, Behind A. K. Patel House, Mithakhali, Cross Road, Ahmedabad - 380 009	2642 76 67 2643 08 98	079-2656 3581
SOUTH	BANGALORE	204-207, Ramanashree Chambers, 2nd Floor, No.37, Lady Curzon Road, Bangalore 560 001	559 26 81 559 21 37 559 62 74	080-559 2823
	CHENNAI	C/o. Arpan Corporation, AVM Studios Compound, 38, Arcot Road, Vadapalani, Chennai 600 026	2372 85 79 2472 67 34	044-2372 8579
	SECUNDERABAD	Krishna Mansion, 2nd Floor, Adjacent to Bible House, 134, Rashtrapati Road, Secunderabad 500 003	2753 45 12	040-2753 1791