Pumps ● Valves ● Systems

Openwell vertical submersible pumps
MONOSUB RV/RV(S)

KSB

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1. General

KSB multistage openwell submersible motor pump units offer trouble free and increased services with proper installation and regular maintenance. Please do not run the unit continuously under operating conditions, which differ from those, specified on nameplate.

This manual does not take into account any site safety regulations, which may apply. It is the pump operator's responsibility that any such regulations exist is adhered to.

This also includes compliance by erection personnel hired.

Observe that the pump type, motor size main operating data and serial numbers etc. clearly appear on the motor nameplate. Quote this information whenever there are any queries or repeat orders and in particular when ordering spares.

The multistage openwell submersible pumps are suitable for installation in open well to pump clean water for various applications like water supply systems, irrigation sprinkling systems, ground water lowering, pressure boosting, fountains etc.

For any additional information or instructions please contact KSB's nearest office.

1.1 Safety of pumping unit

This operating manual contains installation, operation and maintenance instructions. Hence this must be clearly understood by concerned people, prior to installation. The booklet must always be located for easy access at site.

1.1.1 Checks & Safety of pumping unit

Handle the unit carefully, taking special care not to damage the cable (avoid lifting or dragging the motor through cable).

1.1.2 Instructions on unit (Printed matter)

Follow the instructions attached on the motor / pump e.g.

- Arrow indicating the direction of rotation
- Various plugs for water connections viz. filling, venting, draining etc. on motor

1.1.3 For unauthorized spare part and modifications

Modifications or alterations of the equipment supplied are strictly not permitted. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of spurious parts invalidates any liability of the manufacturer for consequential damage.

1.1.4 For unauthorized modes of operation

The warranty related to the operation reliability and safety of the unit supplied is valid only if the equipment is operated according to designated parameters. The operating limits should not differ from the limits specified on the nameplate.

1.1.5 Water characteristics

Multistage open well submersible pumps are designed for handling the clean or slightly contaminated water with the following main characteristics :
(As per IS 14220 : 1994)

a) Turbidity : 50 ppm*, Max (Silica scale)
b) Chlorides : 500 ppm*, Max
c) Total Solids : 3000 ppm*, Max
d) pH value : 6.5 to 8.5
e) Temperature : 33^{0}C, Max
f) Specific gravity : 1.004
g) Hardness : 300, Max (Drinking water)

* ppm - parts per million

2. Installation

2.1 Installation and operational accessories

The motor is supplied with a 5 metre long, 3 core waterproof cable.

The following accessories are necessary for installation and commissioning :

- A cable with vulcanizing rubber compound and electric insulation PVC tapes.
- Control panel
- Rope and rod for hanging the pump set in open well as shown in Fig. 2
- Overload trip unit, water level guard, single-phase preventor (for 3 phase motor).

2.2 Water filling of motor

For filling the motor with pure cold drinking water, follow the procedure given below :

- Place the pump set vertically up.
- Remove the two plugs provided at the top of the motor (Note : One plug is provided to escape the air and another for filling the water).
- Fill the motor completely with pure water having no impurities (Do not use distilled water).
- After filling the motor let it stand for 30 minutes to accelerate the escape of trapped air.
- At the same time pour more water to fill the loss of volume caused by the escaped air bubbles.
- Refit the plugs.
- Check the motor completely for any leakage of water.

Now motor is ready for operation.

If a unit has been in storage for more than 2 months, check for the water filling.

2.3 Insulation Resistance Test

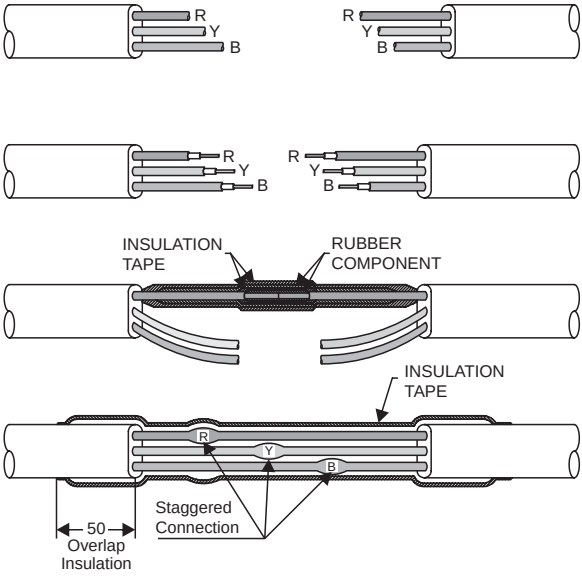
The insulation resistance value of the new motor with 500 V DC Megger is generally 20 Mega Ohms. For old installations, if the value observed to be less than 2 Mega Ohms, please contact KSB or Authorized Dealer before switching on the motor.

2.4 Cable and cable joining

Only the proper cable connector ensures a perfect watertight joint and provides a protection against mechanical damage to the cable jointing. While connecting extra cable beyond standard length along with the pump set, it is necessary to have a watertight cable joint.

a. To connect the cables, a small patch remove insulation the motor cable and join it in staggered fashion where no 2 joints overlap each other.
b. Colors of the leads, which are to be joined together must be identical as per following sketch (Fig. 1).
c. Wrap vulcanizing rubber compound to each cable joint and again wrap with electric insulation tape on the top of it.
d. To ensure proper insulation once again wrap with vulcanizing rubber compound and electric insulation tape for each joint.
e. Finally wind the total cables with electric insulation tape.
f. Oil or grease should not have any contact with the tape.
g. Complete the taping over core insulation at each side.

Please see that each turn of the tape should have a 50% overlap over the previous turn. The tape should be wound on to a thickness at least equal to that of core insulation.



R = Red colored lead
Y = Yellow colored lead
B = Blue colored lead

Fig. 1

2.4.1 Selection of Cable

Voltage drop for extended cable should not be more than 3 % of rated voltage i.e.

Permissible voltage drop = Available voltage x 0.03

For Single phase :
Voltage drop = 2 x Cable Length in meters x Resistance / metre for particular cable size x motor current

Allowed voltage drop is up to 7.0 volts (Considering available voltage 230 volts).

e.g. For the cable length of 50 m and area of cross-section 1.5 mm^2, with rated current 3.5 A,
Voltage drop = 2 x 50 x 0.0121 x 3.5
= 4.24 volts (which is permissible)

For three phase :
Voltage drop = Cable Length in meters x Resistance / metre for particular cable size x motor current

Allowed voltage drop is up to 12.5 volts (Considering available voltage 415 volts).

e.g. For the cable length of 50 m and area of cross-section 1.5 mm^2, with rated current 2.4 A,

Voltage drop = 50 x 0.0121 x 2.4
= 1.45 volts (which is permissible)

Resistance / metre according to cross-section area :

Cross - section area (mm^2)	Resistance in Ohm / m At 30^0C
1.5	0.0124
2.5	0.0075
4.0	0.0047
6.0	0.0031

2.5 Typical installation at site

Use lifting device of suitable capacity to carry the weight of pump unit as well as the weight of pipe filled with water for installation.

2.6 Lowering the pump set

Lower the pump set using suitable chains / rope hooked into two eye bolts provided for vertical installation/suspension. The pump set can be suspended if the bottom of the well is likely to be clogged (clearance for the pump suction due to slush in the well). Delivery pipe should be properly supported so that weight of pipe is not anchored on the pump. To prevent damage to the cable during handling and operation see that it is properly anchored and fastened to the deliver pipe.

2.7 Pump set installation and delivery pipe connection

a. Fit the strainer on adapter to prevent the entry of foreign particles.

b. Connect the delivery pipe to the delivery flange.

c. Tie steel or nylon rope to the two Eyebolts provided on the body and lower the pump set along with the delivery pipe.

d. Clamp the three core cable to delivery pipe with cable clips at regular intervals.

e. Allow the pump set to rest on the bottom/surface or it can be kept hanging in vertical condition.

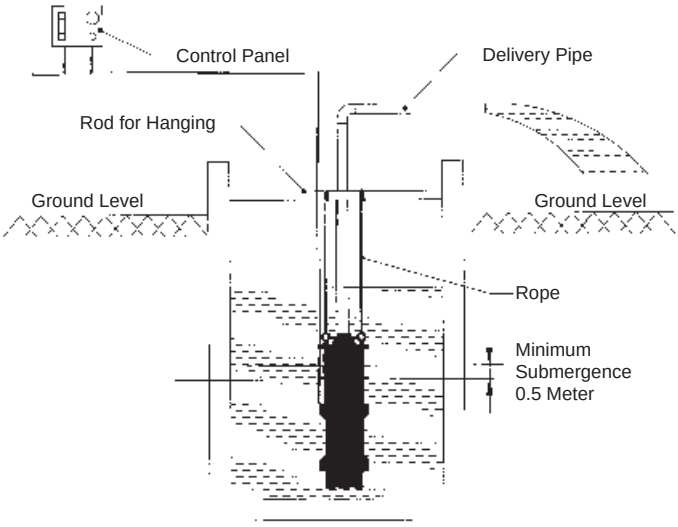


Fig. 2

The open well submersible pump set completely submerged in well.

2.7.1 Plastic / Flexible Rubber riser piping instead of normal GI riser piping

Consult the HDPE / rubber pipe suppliers for the capability of pipes for withstanding the pressure. If the pump is to be fitted with HDPE riser piping, it is to be firmly tied up with stainless steel wire ropes of dia. 2-3 mm to the eyelets on the non return valve body and the vertical pipe line. This precaution will help even in case of GI riser piping.

2.7.2 Installation of water level guard

Install a water level guard for dry running protection to avoid the damage of pump unit in case of water level fluctuations.

2.7.3 Protection against electric shock

Multistage open well submersible pump motors are provided with external earthing plug at upper bearing body as a standard. A three-core cable is led out of the motor. The operator / user shall be responsible for proper connection of the earthed conductor and of control unit at site.

2.7.4 Fixing the power supply cable to the riser pipe

During installation of pump into the open well, power supply cable should be fixed to the riser pipe by means of cable clips at a distance of approx. 3 m immediately after the flange or coupling of the pipe.

2.7.5 Verification of power line with respect to motor design

Verify the voltage and frequency of main supply with the data given on the pump set nameplate.

If it is not matching then consult with concerned electrical authority.

Ensure that the main power supply is stable.

Typical examples of name plate :

Pump name plate :

MULTISTAGE OPENWELL SUBMERSIBLE PUMPSET

KSB PUMPS LTD.

Model No.	MRV 15 - 02 / 3.0				
Sr. No.	127712345		Month / Year	03/11	
Delivery Size	50	mm	Head (Nom)	31	m
No. of Stages	02		Disc. (Nom)	4.50	l/s
Head Range	16 / 38	m	Set Eff.	46	%
Min. Submergence	0.5	m	Phase	3 Ph.	
Rated Speed	2800	rpm	Max. Current	6.50	Amps
Voltage	415 $^{+6\%}_{-15\%}$	V	Hz : 50 ± 3		Cat. : B
Rating	2.2 / 3.0	kW/HP	Conn. : STAR		Duty : S1
Running Capacitor		mfd	Starting Capacitor		mfd

KSB Pumps Ltd. - Plot No. E 3/4, MIDC, Sinnar, Nashik - 422 113. (India)

2.7.6 Trip circuit for over current

A temperature compensated over current relay has to be provided in the operational electrical circuit.

2.7.7 Starting mode

2.7.7.1 For Single - phase motor

Single phase motor connection diagram of starting method DOL is :

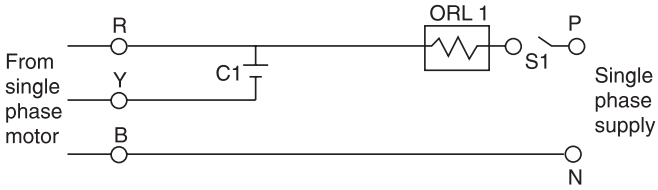


Fig. 3

R : Red color wire
B : Blue color wire
Y : Yellow color wire

S1 : On-Off main switch
S2 : Starting push button

C2 : Starting capacitor
C1 : Running capacitor
ORL 1 : Overload relay

P : Phase
N : Neutral

Caution :
S2 - Starting push button should be pressed max. for 5 sec. In case if the motor does not start, continuous operation of this button may lead to burning the motor.

Capacitor details :
C1 : Running capacitor : Polypropylene (440 V)
C2 : Starting capacitor : Electrolytic (230 V)

MRV (S)

Motor capacity kW	Run Capacitor µF	Start Capacitor µF
0.37	36	N.A.
0.55	36	
0.75	50	
0.93	50	
1.1	50	
1.5	100	

2.7.7.2 For Three - phase motor

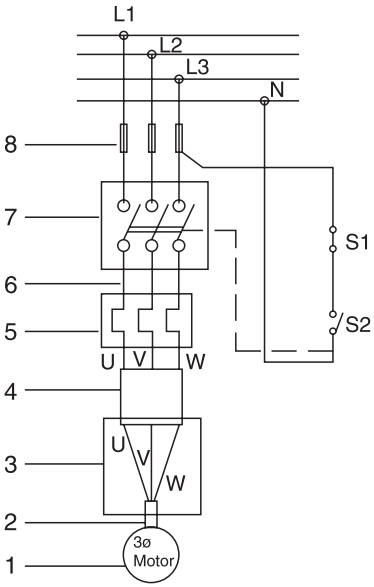


Fig. 4

1. Multistage openwell submersible pump motor
2. Motor cable
3. Cable designation
4. Connected cable
5. Overload relay (thermal type)
6. Leads
7. Electro-magnetic switches
8. Fuses

L1, L2, L3 = Incoming mains
U, V, W = Leads
N = Neutral
S1, S2 = Push buttons

* Overload relay must be of thermal type

3. Commissioning and start up

3.1 Verification of rated current

Please refer to the motor nameplate for the values of rated current required for relay setting.

3.2 Switching ON of mains

The pumping set should be switched on only if it is fully immersed in the water.

3.3 Checking the direction of rotation

For Three-phase motors

1) Let the pump set run for a short time against a closed discharge valve, in both the directions of rotation and check the flow. Reversing of two points of connection, reverses the direction of rotation. The higher flow rate gives the direction of rotation. OR
2) Using pressure gauge, check the discharge pressure in both the direction of rotations. The higher value corresponds to the correct direction of rotation. OR
3) By visual inspection see the flow rate in both cases. If water comes out up to the short length through the riser pipe, flow rate is lower while if it comes farther, results in higher flow rate. The higher flow indicates the correct direction of rotation.

For Single-phase motors

In case of single-phase AC motors the direction of rotation of the motor itself corresponds to the correct direction of rotation of the pump, irrespective of mode of connection to the power supply.

3.4 Operation against a closed discharge valve

Pumps should not be allowed to run against a closed discharge valve for longer than 5 minutes. This would cause the water in the pump to warm up quickly and the heat would be transferred to the motor, which causes a risk to the motor.

3.5 Operation against a throttled discharge valve

If the pump set is to be operated against a throttled discharge valve for a prolonged period of time, the minimum rate of flow should be at least 10% of flow at the best efficiency point* (BEP) of the characteristic curve, this must be observed in order to reduce noisy operation and the overheating of the pump set.

* For best efficiency point (BEP) of the characteristic curve consult with KSB dealer.

3.6 Actual start-up

- Check the power supply condition as per the name plate
- Do proper earthling
- Fix the pressure gauge before control valve
- Set the relay as per current value given on name plate and start the pump.
- Set the duty parameters as per value given on name plate by control valve.
- Pump should run always on duty point specified on name plate

3.7 Operating limits of pump

Operational safety requirements stipulate that pump may only be operated continuously within the flow rate and pump head limits which are specified on nameplate. Otherwise ±10% of best efficiency flow rate should be the pump operation range, provided that motor is not overloaded. (For ensuring this the motor current should not exceed as specified on name plate)

3.8 Switching frequency

In order to prevent the motor from heating up excessively due to many switching cycles, a maximum of 15 starts per hour are permitted with a minimum of 3 minutes interval as a shut down period between two successive starts.

3.9 Interruptions / Shutdown periods

In order to ensure a long motor service life, pumps should not be allowed to remain idle in water for more than 8 to 10 days. Otherwise fine deposits like lime, iron and other substances tend to settle in the bearings and impeller gaps. This might block the pump rotor. In case the situation is unavoidable, it is recommended to run the pump for at least 10 to 15 minutes every week. This will enable the pump to resume instant service at any time.

4. Maintenance

4.1 Storage

Prior to delivery, multistage open well submersible motors are generally preserved and stored up to 1 year.

Always store the motor in upright position protected from dust and frost.

5. Services

Do not attempt to open the pump set for repair that will render our warranty null & void.

Please take up with Authorized Service Centre or to the concerned dealer.

Unauthorized repairs are not permitted since they cause poor performance and shorter life of the pump set.

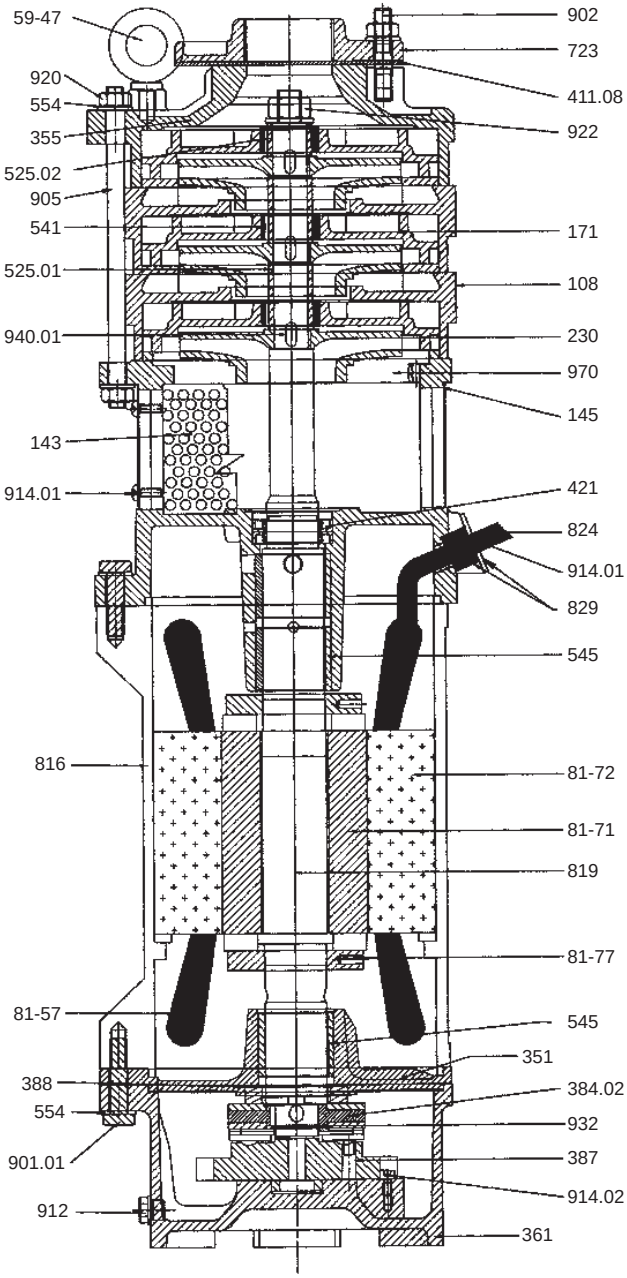
6. Recommended stock of spare parts for 2 years of continuous operation

Part No.	Description	No. of Pumps (Including standby Pumps)						
		1	3	4	5	6	8	10 (More)
143	Suction strainer			1			2	3
384	Thrust bearing plate			1			2	3
421	Oil seal			2 sets			3 sets	4 sets
525	Spacer sleeve			2			3	4
541	Rubber bush			2			3	4
545	Bearing bush			2			3	4
912 / 412	Plugs / O-ring	1		2			3	4
828 / 829	Cable pressure washer / ring	1		2			3	4

7. Trouble shooting

Problem	Probable Cause	Possible remedy
Motor does not start	No power supply	Check power supply, and control panel connection diagram
	Low voltage or single phasing condition.	Operate only within voltages range specified on name plate and ensure balanced 3-phase supply.
	Control panel not functioning because protective devices inside panel are activated. For single phase panels the capacitor could be faulty.	For single phase panel replace capacitor, if found defective.
	Low voltage / Low speed	Check supply voltage and operate only if supply conditions are healthy.
Pump does not deliver water	The clearances between impeller and casing are clogged with foreign particles.	Dismantle and remove obstructions.
	Wrong direction of rotation.	Check the connection : For 3-phase pump sets interchange any 2 phases.
	Wrong selection of pump obstruction in piping.	Select proper pump set.
	Obstruction in piping system.	Clean the pipe.
Pump vibrates, is noisy and drawing excessive current	Foreign particles lodged in impeller.	Clear the impeller and casing.
	Inappropriate pipe fitting.	Fit the pipes properly.
	Motor axial or radial bearing are damaged or shaft is bent.	Replace defective components.
	Sand particles trapped inside or internals corroded	Clean the pump impeller and bearing components, replace if needed.
	Rotating parts are rubbing against stationary parts because radial bearing bush is worn out or shaft is bent.	Replace the defective components.

8. Sectional drawing



Part No.	Description
108	Stage casing
143	Suction strainer
145	Adaptor
171	Diffuser
230	Impeller
351	Bearing housing lower
355	Discharge casing
361	End cover (Motor)
384.02	Thrust carbon bearing plate
388	60 mm Counter bearing
392	Bearing segment carrier
411.01	Rubber gasket
421	Oil seal
525.01	Spacer sleeve
525.02	Spacer sleeve top
541	Rubber bush
545	Bearing bush
554	Spring washer
59-47	Eye bolt
723	Delivery flange

Part No.	Description
81-57	Stator with winding
81-71	Rotor stamping
81-72	Stator stamping
81-77	Balance ring
816	Motor body
819	Shaft
824	Flat cable
828	Cable pressure ring
829	Cable packing clip
901.01	Hex. bolt
902	Stud for flange
905	Tie-rod
912	Drain plug
914.01	Round head screw
920	Dom nut
922	Impeller lock nut
932	Circlip
940.02	Key impeller
970	Suction plate

Zonal Offices :

Chennai : Guindy House, 2nd Floor, 95 Anna Salai, 600 032.
Tel.: 044-2235 2571-2, 2235 5673, 2230 0638 Fax : 044-2235 2749
Kolkata : 30, Circus Avenue, 2nd Floor, 700 017.
Tel.: 033-2287 0473, 2290 0117, 2290 0418, 2281 7293 Fax : 033-2287 0588
Mumbai : 126, Maker Chambers III , Nariman Point, 400 021.
Tel.: 022-6658 8787 Fax : 022-6658 8788
NOIDA : KSB House, A-96, Sector IV, Dist. Gautam Budh Nagar 201 301.
Tel.: 0120-254 1091-93, 254 1501-3 Fax : 0120-255 0567

Service Stations :

Chennai : No.4, (Old No.18), Chakrapani Road, Guindy, 600 032. Tel.: 044-2255 0704
Howrah : 142/1, Foreshore Road, Ramkrishtipur, 711 101. Tel.: 033-2638 2909
NOIDA : KSB House, A-96, Sector IV, Dist. Gautam Budh Nagar 201 301. Tel.: 0120-254 1091-93
Odhav : Shed 22, Gujarat Vepari Mahamandal, Ahmedabad 382 410. Tel.: 079-2290 0372

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Tel.: 079-2657 9610 /11 Fax : 079-2657 9612
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Bhubaneswar : N5/39, (1st Floor), IRC Village, Nayapalli, 751 013.
Tel.: 0674-255 8497, 255 3061, 255 0785 Fax : 0674-255 8499
Chandigarh : S.C.O. 71, 2nd Floor, Sector 30-C, 160 030.
Tel.: 0172-264 0171, 265 2121Fax : 0172-264 0171
Hubli : Plot No. 25, Vaikunte Layout, Near Nehru Nagar Circle, 580 030.
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Tel.: 0141-222 4554, 222 4904 Fax : 0141-222 4904
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Tel.: 0657-2317 129, 2317 130 Fax : 0657-2317 128
Lucknow : 309, Chintel's House, 16, Station Road, 226 001.
Tel.: 0522-263 5203, 263 5597 Fax : 0522-263 5597
Nagpur : 203, Suryakiran Complex, Bajaj Nagar, 440 010.
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Thorat Colony, 411 004. Tel.: 020-2543 1258 / 59 / 60 Fax : 020-2543 1262
Raipur : House No. C/40, 1st Floor, Sector-2, Devendra Nagar, C.G.
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