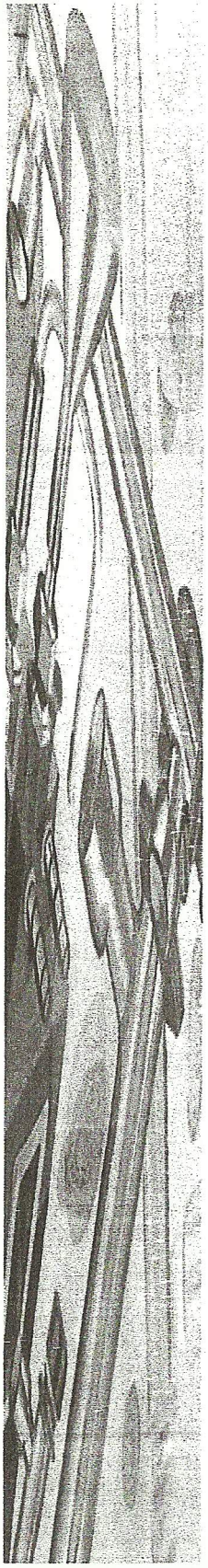

SLURRY MILL

OPERATING MANUAL

SUMA

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CONTENTS

SECTION 1 INTRODUCTION

1.1 Introduction to Slurry Seeding.

The quality of the final sugar crystal boiled in a vacuum pan is largely dependent on the quality of the initial crystals introduced into the pan. Masse containing a high percentage of fine, conglomerated or of very irregular sized crystals will not purge efficiently in the centrifugal machines resulting in poor separation and low yields.

It is generally considered that to grow regular shaped and sized crystals in a vacuum pan, the best method is "full pan seeding" using a sugar slurry seed. This is done by the addition of a specific volume of slurry seed into the vacuum pan when the syrup in the pan is at the correct degree of supersaturation. Slurry seed is a mixture of finely ground sugar suspended in anhydrous ethanol or propanol. The specification of the recommended grade of Propan-2-ol (IPA) is included in **SECTION 5** of this manual. The preparation of slurry seed is easy and the addition of it to the pan easily controlled; the quantity of the slurry used determining the crystal size of the final sugar. By using slurry seeding, Sugar Factories and Refineries alike are able to produce a more regular crystal than can be produced by other methods of graining.

For the very best results, it is essential that the size of the seed in the slurry is as uniform and conglomerate free as possible; this is best achieved using a slurry mill. The **SUMA SLURRY MILL** provides a uniform slurry seed, essential for the production of good quality crystal sugar in both Raw and Refined Sugar production. Unlike the traditional ball mill, the **SUMA SLURRY MILL** uses small steel balls, driven by a high speed paddle, to achieve the grinding action, producing a slurry, the mean size of which is 6.5 microns, with 97% being below 20 microns. Each **SUMA SLURRY MILL** can provide up to seven batches of slurry, each of 6 litres, i.e 42 litres per day.

1.2 **SUMA SLURRY MILL** description.

The mill body is made from heavy walled steel pipe, the bottom being welded to the body and then machine finished. The outlet valve is manufactured from brass.

The top cover and motor gear reducer are bolted to the body for easy maintenance. However it is recommended that the Slurry Mill is not dismantled unless repairs are necessary.

The electric motor and speed reducer are of a mono-block construction, manufactured by DAVID BROWN RADICON Ltd. Further information on these are included under the Installation and Maintenance Sections.

The steel grinding balls are of a specially selected quality and should be available from any good bearing stockist.

1.3 Slurry Seed Ratios and Volumes.

The quantities of sugar and alcohol used to make the slurry seed and the quantity of slurry seed required to seed a pan in order to produce a predetermined final crystal size should be determined by experimentation. In order to maintain good quality control it is important that the slurry is added at a constant and correct degree of supersaturation.

Initially it is recommended that 2.2 kilograms of sugar (for best results use a sugar with a good crystal regularity e.g. plantation white for factories) is milled with 5.0 litres of alcohol. Typically, it has been found that a final crystal mean aperture size of:

0.65 mm can be obtained using 55 ml of slurry seed per 10 m^3 of final masse

& 0.40 mm can be obtained using 177 ml of slurry seed per 10 m^3 of final masse.

It is important that the slurry seed is thoroughly mixed before being measured out for use because the seed will settle to the bottom of the storage container. The container should be kept sealed at all times so that there can be no ingress of water, which would dissolve some of the sugar. Any slurry seed not used after a few days should be discarded and replaced.

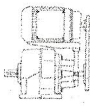
1.4 **SUMA SLURRY MILL** Specification.

Slurry Capacity	6 litres
Typically comprising	2.2 kilograms sugar and 5 litres Propan-2-ol (IPA)
Providing a slurry of masse	33% by weight
Motor	3 Phase Inline Helical Geared Motor
Size	M03209
Power	0.37 kW 380 - 460 Volts, 50 / 60 Hz mains supply
Output Ratio	9:1
Paddle Speed	~ 180 rpm
Grinding Media	¼ inch or 6 mm diameter grade A1 steel balls
Quantity	2.25 kilograms

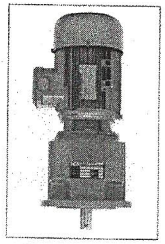
Packing Specification.

Gross Weight	70 kilograms.
Dimensions (Packed)	96 x 43 x 43 centimetres.

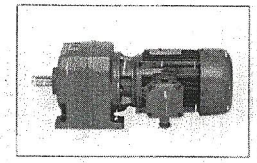
RADICON



The new Series M In Line Geared Motor Units embody everything the name Radicon stands for. Leading edge technology, impeccable quality and unerring reliability that have set world standards in power transmission for over half a century. Pioneering research and advanced design concepts, allied to progressive manufacturing methods and stringent quality management, have resulted in this outstanding range of high quality performers. Combining practicality with economy, the Series M offers today's engineer the most advanced solutions to in-line drive problems that state of the art engineering can provide. A range created for the demands of today, with the requirements of the future in mind.

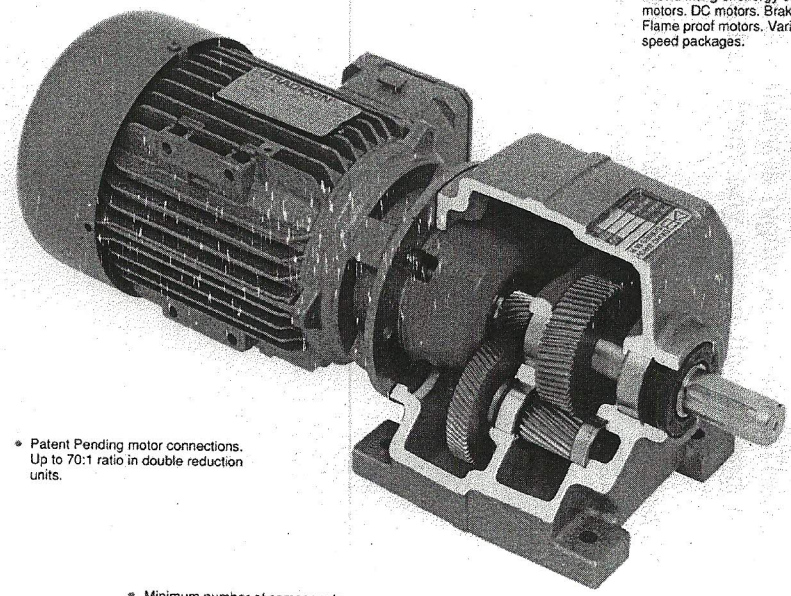


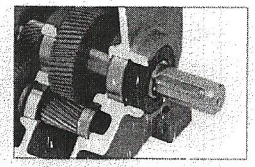
* Flange mounted.



* Clean lines for ease of wash down.

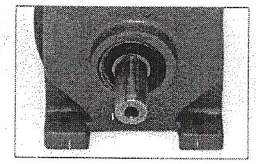
* Standard IEC or NEMA motors. Allows fitting of energy efficient motors. DC motors. Brake motors. Flame proof motors. Variable speed packages.





* Double sealed if required.

* Patent Pending motor connections. Up to 70:1 ratio in double reduction units.



* Dimensionally interchangeable with major European competitors.

* Minimum number of components offers increased reliability and optimum availability.

Since the David Brown organisation was founded in 1860 it has been responsible for a number of significant developments which have gained world-wide acclaim. Amongst them was the introduction in 1912 of a patented involute helicoidal worm thread form, and the development of phosphor bronzes for wormwheels which have become almost standard throughout the industry.

The organisation produced history's first commercial gearbox in 1903 and 30 years later came one of the most momentous events – the introduction of innovatory versions with ribbed casings and integral cooling fans. These features brought unprecedented performance in the dissipation of heat by a combination of RADiation and CONvection. The name Radicon was born!

The revolutionary features were subsequently applied to various additional types of geared power transmission and drive units developed over the years to form a comprehensive range meeting all requirements. The evolving demands of industry allied to developments in technology have seen refinement and change, but Radicon has always been a dynamic leader rather than a follower in the cause of progress.

Each successive generation of units has pushed back the barriers, introducing new levels of cost-cutting performance and reinforcing the Radicon reputation for quality, technical innovation and customer satisfaction. The Series M has all those characteristics and more.....

Series M in-line geared motor units offer ratios from 1.40:1 to 250:1, and in combined unit form up to 62,500:1. Motors are available up to 90 kW, giving maximum output torque of 11000 Nm.

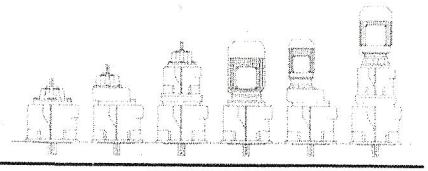
The choice of base or flange-mounting versions means that all in-line drive requirements can be met with units accepting standard IEC or NEMA electric motors; variable speed and clutch brake modules can also be fitted.

Marked by their extreme reliability, Series M units incorporate a number of advanced features including, for example a patent pending standard motor connection.

Interchangeability with early Radicon models of similar general type, and with corresponding versions by most other major European suppliers, means these superb examples of Radicon technology can be fitted without any major difficulty.

The benefits of advanced design, high grade materials and quality manufacture are maximised by high internal efficiency to ensure a long and trouble-free operational life, with simple maintenance routines kept to an absolute minimum.

Where an application requires an in-line geared motor drive, there is no better solution than a Series M.



SERIES M IN LINE GEARED MOTOR UNITS

Technical excellence...Commercial vision

SECTION 2 INSTALLATION

2.1 Unpacking.

Remove the **SLURRY MILL** from it's packing case. It is recommended that the box is retained in the unlikely event that the **SLURRY MILL** has to be returned to TLPT for repair. Ensure that the following items are present:

1. **SLURRY MILL**
2. Plastic half-funnel
3. Cable clamp (attached to the motor terminal box)
4. **SUMA SLURRY MILL** Operating Manual

2.2 Positioning.

After unpacking the **SUMA SLURRY MILL**, it should be installed on a sturdy bench, preferably about 650 mm above floor level. It should be firmly fitted to the bench, using either coach screws directly into or bolts through the bench top.

A hole needs to be drilled through the bench top, below the **SLURRY MILL**, so that a plastic tube can be connected to the outlet valve to feed a container, of at least 5 litres capacity, sited on the floor below the bench.

The alcohol used for the slurry is highly flammable. The mill must therefore be located in a ventilated area that is free from any naked flames and hot electrical elements and where smoking is forbidden.

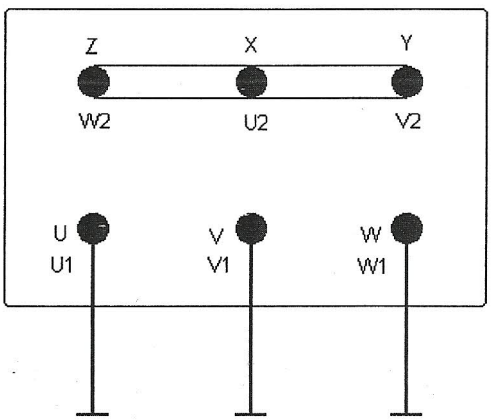
Remove the red transit grub-screw from the filling plug and check that the outlet valve is free and in the closed (horizontal) position.

2.3 Mains Supply.

Only a qualified person, using the correct size of cable according to electrical regulations should make the connection of the motor to the mains supply.

The motor is a 0.37 kilowatt 3 phase geared motor and is suitable for use with either a 380 - 415 Volts - 50 Hz supply or a 400 - 460 Volts - 60 Hz supply. In either case it should be connected as a Star Circuit (High Voltage). The **SLURRY MILL** motor can be run in either direction.

STAR CIRCUIT (HIGH VOLTAGE)



SUPPLY LINES

Enough spare cable should be left, about 40 cms, in order to allow the **SLURRY MILL** lid and paddle to be comfortably raised above the top flange during maintenance. The starter for the motor should be mounted on a wall, well away from the **SLURRY MILL**, so that no liquids can be splashed on it. It is recommended that an ammeter is incorporated with the starter, as an aid to monitoring performance.

In order to achieve a consistent quality of the slurry milled, it is important that the length of time of milling is constant; it is therefore recommended that a timer also be fitted. Because the **SLURRY MILL** should be emptied as soon as the milling is stopped, the timer should only be wired to initiate some form of alarm and **not** be wired to stop the **SLURRY MILL**.

SECTION 3 OPERATING INSTRUCTIONS

3.1 Initial Start Up.

The **SUMA SLURRY MILL** has been run for at least a 24 hour test period as part of it's inspection procedure. When first being commissioned, or after any long periods of non use, the following flushing procedure should be adopted:

1. Remove the brass filler plug and insert the half funnel in the filler tube. Fill the **SLURRY MILL** with 5 litres of the alcohol to be used. **NEVER** use Gasoline.
2. Remove the funnel and replace the brass filler plug. The filler plug must always be in place when the **SLURRY MILL** is being run.
3. Start the motor and run the **SLURRY MILL** for 1 hour.
4. Stop the motor and discharge the alcohol to waste.
5. Restart the motor and rinse the **SLURRY MILL** with about 1 litre of alcohol for about 5 minutes.
6. Discharge this alcohol to waste with the motor running. Then stop the motor with the valve open.
7. The **SLURRY MILL** is now ready to use.

3.2 Normal Operation.

1. Ensure that the discharge valve is closed, remove the brass filler plug and insert the half-funnel in the filler tube.
2. Add approximately 3 litres of a suitable grade alcohol (refer to section 1.3 Slurry Seed Ratios and Volumes for further information on volumes).
3. Start the motor and check, if an ammeter is fitted, that the current is in the order of 1 amp.
4. Add 2.2 kg of ordinary granulated sugar, plus the 'flushings' from the previous milling (see operation 6). Add the remainder of the 5 litres of alcohol. Remove the funnel and replace the brass filler plug. The filler plug must always be in place when the **SLURRY MILL** is being run.

   Never reverse procedures 2 to 4 as the SLURRY MILL is not designed to grind dry sugar.
5. Set the timer (if fitted) to 3 hours and leave **SLURRY MILL** to run for 3 hours.
6. After the 3 hours operation stop the **SLURRY MILL** and then flush the discharge valve by opening and running off approximately 50 ml of slurry into a plastic beaker - this should be saved and added to the next milling (see operation 4). This is to ensure that any unmilled crystals that may have been trapped in the bottom of the SLURRY MILL are flushed out and do not form part of the seed.
7. Restart the **SLURRY MILL** and place a plastic bottle, of at least 6.5 litres capacity, under the bench, allowing the plastic tube connected to the discharge valve to hang loose inside the neck of the bottle.
8. Open the discharge valve and stop the **SLURRY MILL**. Note that this is the reverse order of operation to that in operation 6.
9. After the flow of slurry has stopped, briefly start and stop **the SLURRY MILL** to ensure that all of the slurry has been discharged.

   Do not stop the SLURRY MILL leaving slurry inside for any great period of time.

3.3 Routine Cleaning of the **SUMA SLURRY MILL.**

Providing that the procedures in 3.2 Normal Operation are adhered to, if a further batch of slurry is to be milled within a few days, no cleaning of the mill is necessary. If however no further milling is required within a few days, it is recommended that the **SLURRY MILL** is rinsed out with about 2 litres of alcohol with the motor running for about 30 minutes, emptied and left empty with the valve open.

If the **SLURRY MILL** is unlikely to be used for a prolonged time, such as between crops, it should be washed out several times with hot water, to dissolve any remaining sugar, and then rinsed several times with alcohol until it is clean. The **SLURRY MILL** should then be filled with 200 ml of a non acid mineral oil, run for about 30 minutes, emptied and left empty with the valve open.

Prior to being used again, at the beginning of crop, the **SLURRY MILL** should be cleaned as in Section 3.1, Initial Start Up.

SECTION 4 MAINTENANCE

4.1 Motor and Gear Box Lubrication.

The lubricant for the motor and gear box should never need replacing as it is filled for life. If however it should need to be replaced, then it should be filled with 0.8 litres of 320/6E mineral or 320/6H synthetic oil.

4.2 Motor and Gear Box, External Surface.

With the drive stationary, periodically clean any dirt or dust from the gear unit and the electric motor cooling fins and fan guard. This will aid the cooling and prolong the life of the unit.

4.3 Impeller.

In the very unlikely event that the impeller should need replacing, then full fitting instructions will be supplied with the spare paddle.

4.4 Grinding Media.

Broken or badly worn balls can damage the **SLURRY MILL**. If the power consumption is seen to increase at any time or if any screeching noises are noticed, the **SLURRY MILL** should be stopped immediately and the balls be inspected. In any event, with continuous usage, the condition of the balls should be determined by inspection at least every six months, as follows:

1. Electrically isolate the motor
2. Remove the plastic tube from the outlet valve and place an open container under the valve.
3. Open the discharge valve.
4. Remove all the socket head screws around the flange. Lift the vessel lid, complete with the motor geared unit & paddle, and rest it on the top flange.
5. All the balls should drop into the container.
6. Visually check the condition of the paddle and the inside of the **SLURRY MILL**. Providing that there is no sign of damage or excess wear, by holding the motor, replace the vessel lid; taking care not to drop or damage it in any way.
7. Visually inspect the condition of the steel balls in the container and replace any damaged, badly worn or suspect balls as necessary. A full charge of steel balls is 2.25 kg of ¼" or 6 mm diameter Grade A1 ball bearings.
8. Reload the balls via the filler tube, using the half-funnel.

4.5 Spares.

In case of ordering spare parts for the **SUMA SLURRY MILL**, always quote the serial number of the **SLURRY MILL**, as given on name plate in front of the milling pot.

SECTION 5 Propan-2-ol

5.1 Nomenclature.

Propan-2-ol is alternatively known as Iso-propyl alcohol, Propanol-2 and Isopropanol.

5.2 Description.

Propan-2-ol is a stable, colourless, highly flammable liquid used as a solvent and as a chemical intermediate. The major solvent use is in paints, varnishes and printing inks.

Important chemical uses are the manufacture of esters, acetone and glycerol. Its low odour makes it an acceptable component of cosmetic and toiletry products.

5.3 Specification.

Propanol-2-ol 'S' grade is a dry grade complying with the British Standard Specification BS.1595:1986. This grade also complies with the American Society for Testing and Materials (ASTM) Specification D770 and with the British Pharmacopoeia monograph on Isopropanol.

'S' grade complies with the following specification:

Density in air at 20° C		784-786 kg/m^3
Distillation Range at 1.013 bar		
Initial boiling point		82.0° C
min dry point		83.0° C max
Residue on evaporation	% mass max	0.002
Water Content	% mass max	0.10
Miscibility with water.		Complete
Fixed acidity as acetic acid.	% mass max	0.001
Alkalinity		Nil
Alcohol content as Propan-2-ol	% mass max	99.7
Aldehydes and Ketones.	% mass max	0.05
Colour	Hazen Units max	15

The tests relating to the above specification are carried out in accordance with methods described in the British Pharmacopoeia.

Weight/Volume relationship:

1 metric tonne is equivalent to approximately 1274 litres at 20° Centigrade.